

MICROFICHE LAYOUT

1. Read from left to right.
2. Title of microfiche (appears on each coordinate).

E16 | Product/assembly/test step |

Coordinate

3. Limits of section

Beginning

Mid-section

End

One page section

4. Vehicle-specific special features are marked on the coordinates. A27...A28 with the adjacent symbol (e.g. installation positions etc.).

A01 | |

SPECIAL FEATURES

This microcard applies to ABS testing with the ABS tester ETT 016.00 (0 684 101 600) for the following vehicles:

Audi 80, 90, 100, 200, and 5000 as of series start in each case.

Model year 85 has been incorporated.

ABS in the Audi includes 4 wheel-speed sensors and a 4-circuit hydraulic modulator for a diagonal brake-circuit system.

The Audi Quattro vehicles are not included. A separate microcard has been made up for them.

RAPID DIAGNOSIS CHART FOR ABS TESTER

The following rapid diagnosis chart makes it possible for the experienced ABS specialist to rapidly check the ABS system using the ABS tester.

If detailed information and instructions are necessary, the last column refers to the coordinates containing the detailed test step.

The following test requirements must be met prior to testing with the ABS tester.

A02 | |

Test requirements for testing with the ABS tester

- * The tester must have been converted to the latest technical standard (designation "U2" on nameplate or as of FD 352).
- * Check ground connection of return pump and over-voltage-protection relay term. 31 for firm seating and corrosion.
- * Check hydraulic connections and sealing points on hydraulic modulator for leakage (visual inspection).
- * If the ABS warning lamp sometimes lights up during driving (e.g. after switching on consuming devices) and then goes out again by itself, check the battery and voltage supply (generator, regulator, and voltage drops).
- * If the ABS warning lamp continually lights up and does not go out, check the following points:
 - > Does the multiple plug show correct seating at the controller, and is it engaged?
Are all plug contacts OK?
Are all spring contacts engaged?
 - > Is V-belt torn?
(Generator delivers no voltage, charge and ABS warning lamps come on).
 - > Does generator term. 61 deliver voltage?
Are plug connection and lead to ABS controller OK?
 - > Check for loose contacts for wheel-speed sensors in program-switch position 10.

* Switch on ignition in all program-switch positions for testing with the tester (tester uses current from vehicle battery).

* Observe tester lamps 1 and 2 in all program-switch positions.

I M P O R T A N T !

Do not drive with tester connected!

The entire test program should be repeated after every repair.

General trouble-shooting information

Check all leads for ground connection and contact with positive leads, as well as looking out for abrasion and pinching.

* Connect ABS tester to controller and ABS wiring harness.

I M P O R T A N T !

Connect and disconnect the controller only with the ignition switched off.

The installation position of the controller is:

- in the Audi 200 until 8.83,
underneath the glove compartment;
- in the Audi 100 and 200 as of 9.83,
underneath rear seat on left;
- in the Audi 80 and 90,
in trunk on the left.

RAPID DIAGNOSIS CHART FOR ABS TESTER ETT 016.00 (0 684 101 600)

Program-switch position	Subject of testing	Measurement at controller terminals	Additional operation	Test specifications (reading)	For trouble-shooting, see Coordinates
1...24	Voltage supply at every test step	1 (+) and 10 (-)	Ignition on	Lamp 1 (green) must light up in each test step	C03
1	Valve relay - off-position	32 and 10	Ignition on	Lamp 1 (green) and lamp 3 (green) must light up	C09
2	Valve relay - functioning	32 and 10 Negative at 27.	Ignition on	Lamp 1 (green) and lamp 3 (green) must light up	C11
3	Engine relay - off-position	14 and 10	Ignition on	Lamp 1 (green) and lamp 3 (green) must light up	C13
4	Engine relay - functioning	14 and 10 Negative at 28	Ignition on. Press illuminated button:	Lamp 1 (green) and lamp 3 (green) must light up. Pump motor running.	C15
5	Fuse and Z-diode in over-voltage protection relay or combination relay. (The relay which is plugged into the test plug on the tester is the subject of testing).	1 and 10	Ignition off. Disconnect controller. Plug vehicle relay into test plug on rear of tester using adapter cable. Plug in new relay in vehicle. Switch on ignition, wait about 1 s, then press illuminated button. After testing, switch off ignition and re-connect controller.	Lamp 1 (green) must light up and remain lit. After pressing the illuminated button, lamp 3 (green) must light up.	C17

Program-switch position	Subject of testing	Measurement at controller terminals	Additional operation	Test specifications (reading)	For trouble-shooting, see Coordinates
6	Internal resistance of solenoid-operated valves in hydraulic modulator	2 and 32 35 and 32 18 and 32 19 and 32	Ignition on. Press button VL: Press button VR: Press button HL: Press button HR:	Lamp 1 (green) must light up and stay lit. VL: 0,7...1,7 Ω VR: 0,7...1,7 Ω HL: 0,7...1,7 Ω HR: 0,7...1,7 Ω	C19
7	Ground connection to terminal 10	10	Ignition on. Press illuminated button.	Lamp 1 (green) must light up and stay lit. 30...300 mV	C27
8	Ground connection to terminal 34	34	Ignition on. Press illuminated button.	Lamp 1 (green) must light up and stay lit. 10...250 mV	D01
9	Ground connection to terminal 20	20	Ignition on. Press illuminated button:	Lamp 1 (green) must light up and stay lit. 10...250 mV	D03
10	Internal resistances of wheel-speed sensors	4 and 5 21 and 23 7 and 9 24 and 26	Ignition on. Press button VL: Press button VR: Press button HL: Press button HR:	Lamp 1 (green) must light up and stay lit. 0,8...1,8 k Ω 0,8...1,8 k Ω 0,8...1,8 k Ω 0,8...1,8 k Ω	D05
11	Insulation resistances of wheel-speed sensors	5 and 10 23 and 10 7 and 10 24 and 10	Ignition on. Press button VL: Press button VR: Press button HL: Press button HR:	Lamp 1 (green) must light up and stay lit. 20...999 k Ω 20...999 k Ω 20...999 k Ω 20...999 k Ω	D25

Program-switch position	Subject of testing	Measurement at controller terminals	Additional operation	Test specifications (reading)	For trouble-shooting, see Coordinates
12	DC voltage at wheel-speed-sensor leads	5 and 10 23 and 10 7 and 10 24 and 10	Ignition on. Press button VL: Press button VR: Press button HL: Press button HR:	Lamp 1 (green) must light up and stay lit. VL: 000 ... 100 mV VR: 000 ... 100 mV HL: 000 ... 100 mV HR: 000 ... 100 mV	E09
13	Controller internal supply voltage	12 and 10	Ignition on. Press illuminated button:	Lamp 1 (green) must light up and stay lit. 8,85...9,15 V (Controllers have blue stickers in some cases). As of 9.83 the following applies to generation 2 B: 4,75...5,25 V (Controllers have green stickers in some cases)	E21
14	Diode (in hydraulic modulator) in forward direction and ABS warning lamp	29 and 32	Ignition on.	0,4...1,5 V ABS warning lamp in vehicle must light up.	E23
15	Diode (in hydraulic modulator) in reverse direction	29 and 32 Negative at 29	Ignition on.	2,5...8,5 V ABS warning lamp shines somewhat less brightly.	F01
16	Controller, BITE initiation (BITE = built-in test electronics)	29 and +	Ignition on. Press illuminated button for at least 3 seconds:	ABS warning lamp must go out after max. 1 second.	F07
17	Controller, BITE fault simulation	29 and +	Ignition on. Press illuminated button for at least 3 seconds:	ABS warning lamp must light up and stay lit (flickering after about 1 second permissible).	F09

Program-switch position	Subject to testing	Measurement at controller terminals	Additional operation	Test specifications (reading)	For trouble-shooting, see Coordinates
18	Controller current for maintaining pressure	2 35 18 19	Ignition on. Press button VL, press illuminated button: Press button VR, press illuminated button: Press button HL, press illuminated button: Press button HR, press illuminated button:	Lamp 1 (green) must light up and stay lit. VL: 1,9...2,3 A VR: 1,9...2,3 A HL: 1,9...2,3 A HR: 1,9...2,3 A	F11
19	Controller, current for pressure reduction	2 35 18 19	Ignition on. Press button VL, press illuminated button: Press button VR, press illuminated button: Press button HL, press illuminated button: Press button HR, press illuminated button:	Lamp 1 (green) must light up and stay lit. VL: 4,5...6,0 A VR: 4,5...6,0 A HL: 4,5...6,0 A HR: 4,5...6,0 A	F13
24	Brake-light-switch voltage. Applies as of Generation 2 B as of 9.83).	25 and 10	Ignition on. Operate brake pedal:	10...15 V	F15

A dynamic brake analyzer (brake test stand) (BPS) is required for program-switch positions 20, 21, 22, and 23. Do not drive with tester connected! Do not use a brake-pedal-actuating device to set the braking force! Always proceed with program-switch position 23 first.

Front axle

Drive front wheels onto brake analyzer. Pull parking brake.

Program-switch position	Subject of testing	Measurement at controller terminals	Additional operation	Test specifications (reading)	For trouble-shooting, see Coordinates
23	Wheel-speed-sensor signal and correct connection check	4 and 5	Press button VL, switch on left brake roller.	VL: 1,7...19	F19
		21 and 23	Press button VR, switch off left brake roller, switch on right brake roller.	VR: 1,7...19	F25
20	Check of hydraulic-modulator pressure reduction and correctness of connections	Current feed to term. 35	Press button VR. Switch on right brake roller. Depress brake pedal and hold at a constant 2000 N. Press illuminated button.	VR: less than 1100 N	G03
		Current feed to term. 2	Press button VL. Switch off right brake roller. Switch on left brake roller. Depress brake pedal and hold at a constant 2000 N. Press illuminated button.	VL: less than 1100 N	G05
21	Hydraulic-modulator pressure buildup	Current feed to term. 2	Press button VL, switch on both brake rollers. Depress brake pedal and hold at a constant 2000 N. The maximum allowable difference between both wheels is 500 N. Press illuminated button.	Brake-analyzer reading on left goes to an intermediate value and then climbs back up to VL: 600...1700 N.	G11

Program-switch position	Subject of testing	Measurement at controller terminals	Additional operation	Test specifications (reading)	For trouble-shooting, see Coordinates
21	Hydraulic-modulator pressure buildup	Current feed to term. 35	Press button VR. Switch on both brake rollers. Depress brake pedal and hold at a constant 2000 N. Press illuminated button.	Brake-analyzer reading on right goes to an intermediate value and then climbs back up to VR: 600...1700 N	G13
22	Hydraulic-modulator pump delivery, 1st brake circuit	Current feed to term. 35	Switch on brake rollers. Read intrinsic friction coefficient on right. Press button VR. Depress brake pedal and hold at a constant 2000 N. Press illuminated button.	After an intermediate value on the right the return pump comes on briefly. The reading must fall below an intrinsic friction coefficient on the right of plus 200 N. Depress illuminated button until the reading rises back to 2000 N	G15
	Hydraulic-modulator pump delivery, 2nd brake circuit	Current feed to term. 2	Switch on brake rollers. Read off intrinsic friction coefficient on left. Press button VL. Depress brake pedal and hold at a constant 2000 N. Press illuminated button.	After an intermediate value on the left the return pump comes on briefly. Reading must fall below an intrinsic friction coefficient on the left of plus 200 N. Depress illuminated button until the reading rises back to 2000 N	G17

Rear axle:

Drive rear wheels onto dynamic brake analyzer. Release parking brake.

On vehicles with automatic transmission, move selector lever to position "N".

Program-switch position	Subject of testing	Measurement at controller terminals	Additional operation	Test specifications (reading)	For trouble-shooting, see Coordinates
23	Wheel-speed-sensor signal and correct connection check	7 and 9	Press button HL, switch on left brake roller.	HL: 1,7...19	G19
		24 and 26	Press button HR, switch off left brake roller, switch on right brake roller.	HR: 1,7...19	G25
20	Hydraulic-modulator pressure reduction and correct connection check	Current feed to term. 19	Press button HR. Switch on right brake roller. Depress brake pedal and hold at a constant 1200 N. Press illuminated button.	HR: less than 800 N	H03
		Current feed to term. 18	Press button HL. Switch off right brake roller. Switch on left brake roller. Depress brake pedal and hold at a constant 1200 N. Press illuminated button.	HL: less than 800 N	H09
21	Hydraulic-modulator pressure buildup	Current feed to term. 18	Press button HL. Switch on both brake rollers. Depress brake pedal and hold at a constant 1200 N. The maximum permissible difference between both wheels is 400 N. Press illuminated button.	Brake-analyzer reading on left goes to an intermediate value and then rises back to HL: 400...1100 N	H11
		Current feed to term. 19	Press button HR. Switch on both brake rollers. Depress brake pedal and hold at a constant 1200 N. Press illuminated button.	Brake-analyzer reading on right goes to an intermediate value and then rises back to HR: 400...1100N	H13

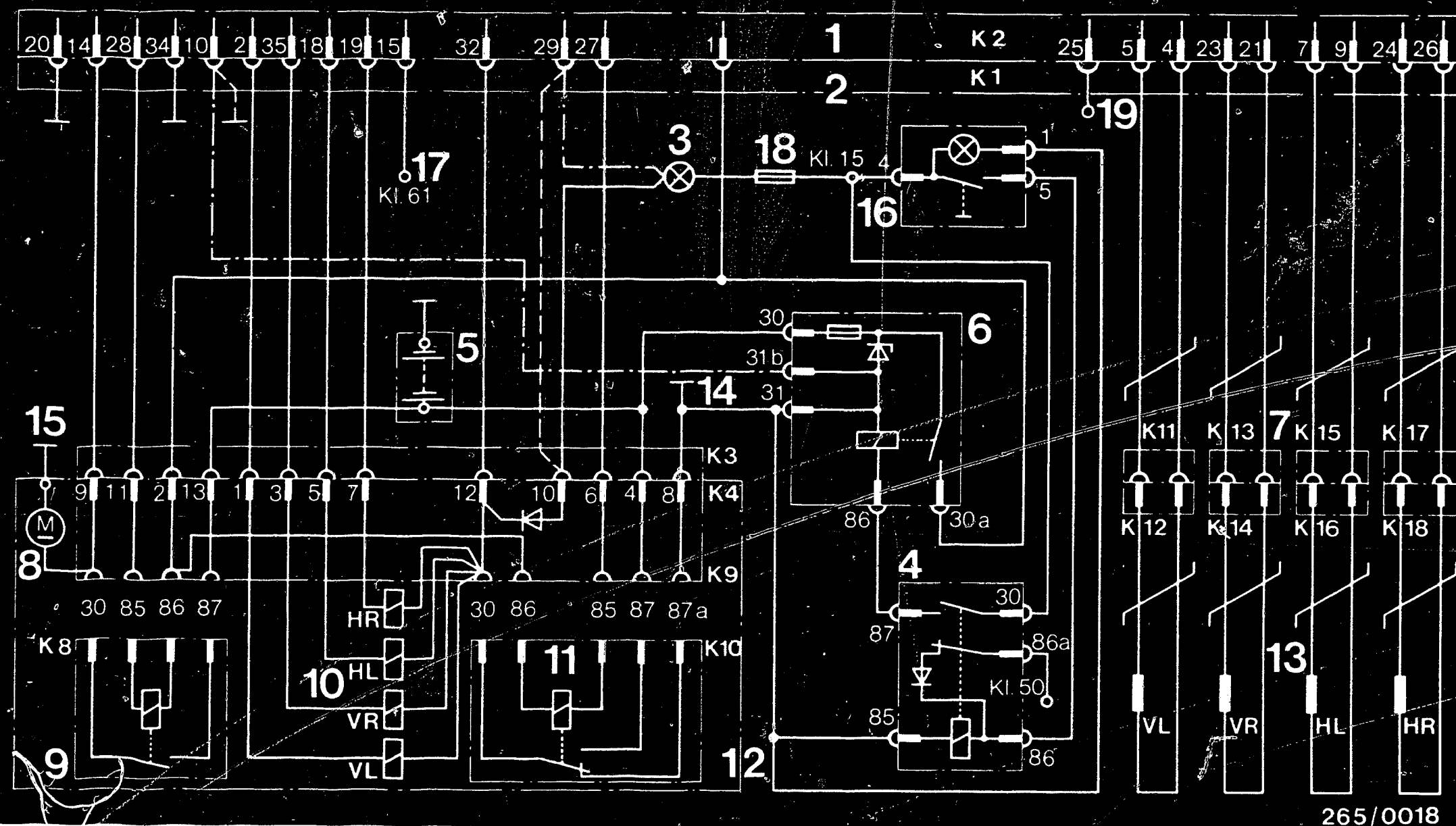
As a final test, do a test drive. The warning lamp must go out when the engine is running. Drive at least 30 km/h. The warning lamp must not come back on.

TEST SPECIFICATIONS

Testing of the ABS should be done only with the ABS tester for reasons of safety.

The test program contains all important test specifications as well as information on testing and replacing components.

For production reasons:
continued on the following
coordinate.

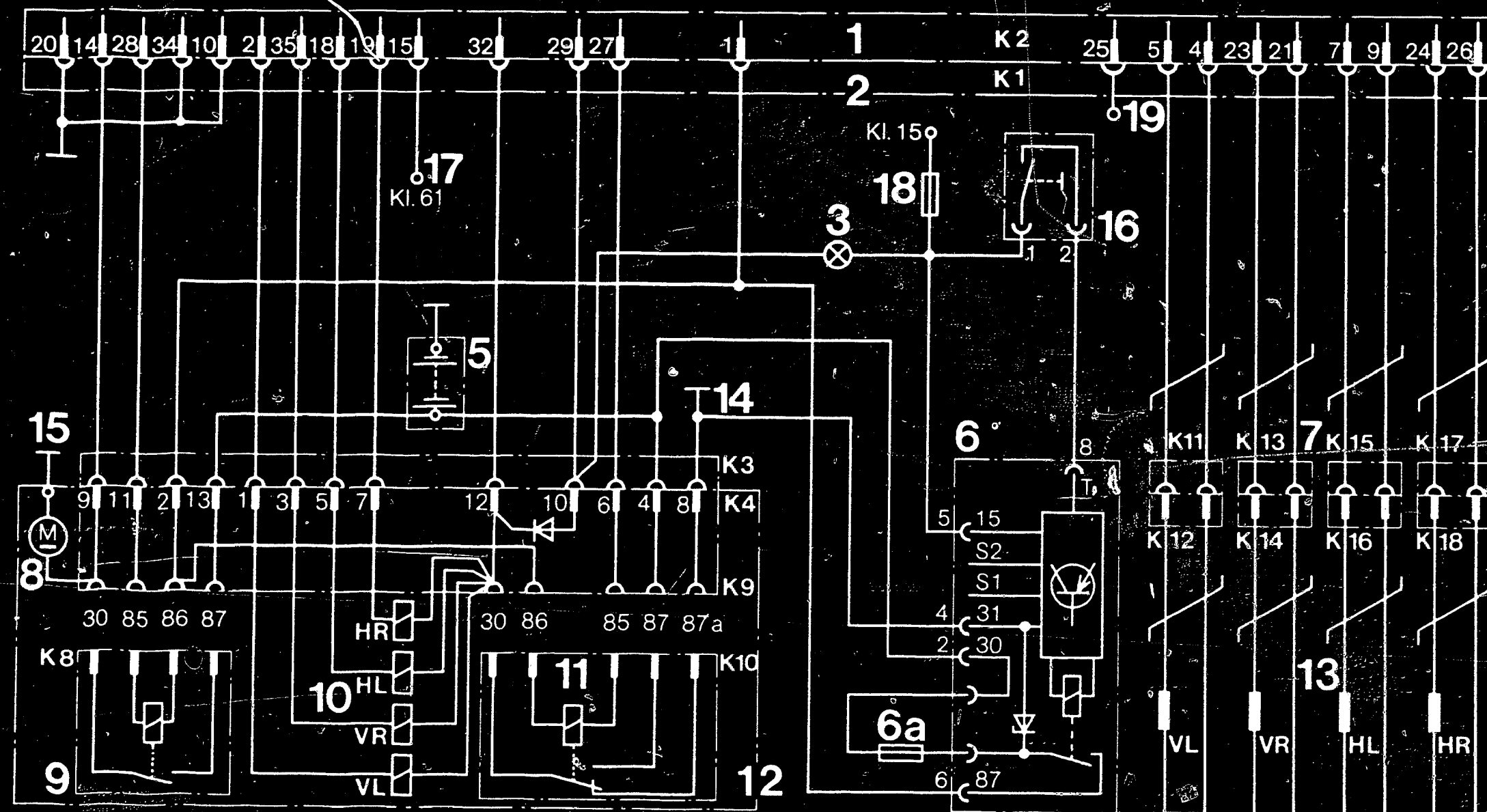


265/0018

- | | |
|--|--|
| 1 = Electronic controller | 12 = Hydraulic modulator |
| 2 = Multiple plug (35-pin) | 13 = Wheel-speed sensor |
| 3 = ABS warning lamp | 14 = Ground terminal behind switchboard |
| 4 = Relay for controller
(step-by-step relay) | 15 = Ground terminal, eng. comp. on left |
| 5 = Battery | 16 = ABS switch |
| 6 = Over-voltage-protection relay | - - - = valid as of 9.83 |
| 7 = Multiple butt connector | -.-.- = n/a as of 9.83 |
| 8 = Return-pump motor | 17 = To alternator |
| 9 = Engine relay | 18 = Fuse in relay board
with fuse holder |
| 10 = Solenoid-operated valve | 19 = To stop-lamp switch
(as of Generation 2 B) |
| 11 = Valve relay | |

VL = Front left
 VR = Front right
 HL = Rear left
 HR = Rear right
 K1, K2 etc.
 = Plug numbers

ELECTRICAL TERMINAL DIAGRAM (until 7.84)



26510235

- 1 = Electronic controller
- 2 = Multiple plug (35-pin)
- 3 = ABS warning lamp
- 5 = Battery
- 6a = Plug fuse (10 A)
in combination relay
- 6 = Combination relay
- 7 = Multiple butt connector
- 8 = Return-pump motor
- 9 = Engine relay

- 10 = Solenoid-operated valves
- 11 = Valve relay
- 12 = Hydraulic modulator
- 13 = Wheel-speed sensor
- 14 = Ground terminal behind switchboard
- 15 = Ground terminal, eng. comp. on left
- 16 = ABS switch
- 17 = To alternator
- 18 = Fuse in relay board
- 19 = To stop-lamp switch

- VL = Front left
- VR = Front right
- HL = Rear left
- HR = Rear right
- K1, K2 etc.
= plug numbers

Electrical terminal diagram (as of 8.84 with combination relay)

TEST EQUIPMENT AND TOOLS

Description	Designation	Part number
ABS tester Use only converted testers! Designation "U2" on nameplate or as of FD (date of manufacture)352	ETT 016.00	0 684 101 600
Adapter cable for connection of over-voltage-protection relay or combination relay		1 684 460 120
Dynamic brake analyzer	e.g. BPS 100 or BPS 101 or BPS 104 or BPS 105	0 680 012 .. 0 680 013 .. 0 680 018 .. 0 680 019 ..
Charging and bleeder device		e.g. ATE part no.3.9302-1000,4 1)
Bleeder fitting for connecting the charging and bleeder device to the fluid reservoir of the main cylinder		ATE part no. 3.9302.0702.2 1)
Bleeder hose		ATE part no. 3.3590.2300.1 1)
Additional hose		ATE part no. 3.9302.0704.2
Brake-pedal-actuating device		ATE part no. 3.9312.0100.4 1)

1) = can be ordered from Alfred Teves GmbH
Guerickestraße 7
6000 Frankfurt / Main
West Germany

Test equipment and tools (continued)

Description	Designation	Part number
Pressure tester Tester for low- and high-pressure testing of hydraulic braking systems		e.g. ATE part no.3.9305-0200,4 1)
Double-head flare nut wrench, 9 x 11 mm		Hazet part no. 612 2)
Container, approx. 1 l, for catching brake fluid		
Brake fluid: Use only ATE original brake fluid, DOT 4 or VW brake fluid!		
Electric tester or Multimeter for trouble-shooting	ETE 014.00	0 684 101 400 Commercially available
Grease for wheel-speed sensors		Molykote Longterm 2
Protective caps for brake lines		1 900 508 002 (100 each)
Protective caps for brake-line connections to hydraulic modulator		1 900 508 004 (100 each)
Use only original VW brake lines!		

1) = can be ordered from: Alfred Teves GmbH
Guerickestraße 7
6000 Frankfurt / Main
West Germany
2) = can be ordered from: H a z e t Co.
5630 Remscheid
West Germany

INSTALLATION POSITION OF COMPONENTS

Installation-position information is always with reference to the direction of travel.

* ABS warning lamp:

In dashboard.

* ABS switch:

In dashboard.

* Wheel-speed sensors, front axle

One each on left and right in steering knuckles.

* Wheel-speed sensors, rear axle:

One each on left and right near brake calipers.

* Hydraulic modulator:

In engine compartment on left in front of main brake cylinder.

* Ground terminal for ABS:

On mounting for hydraulic modulator.

* Controller:

Audi 100 and Audi 200 (as of 9.83):
On left below rear seat.

Audi 200 (until 8.83):
Underneath glove compartment.

Audi 80 and 90:
In trunk on left.

* Relay for controller: (until 7.84)

On left below switchboard.

Audi 100 (until 8.83):
Relay position 8;

Audi 100 and 200 (as of 9.83):
Relay position 7.

* Over-voltage-protection relay (until 7.84):

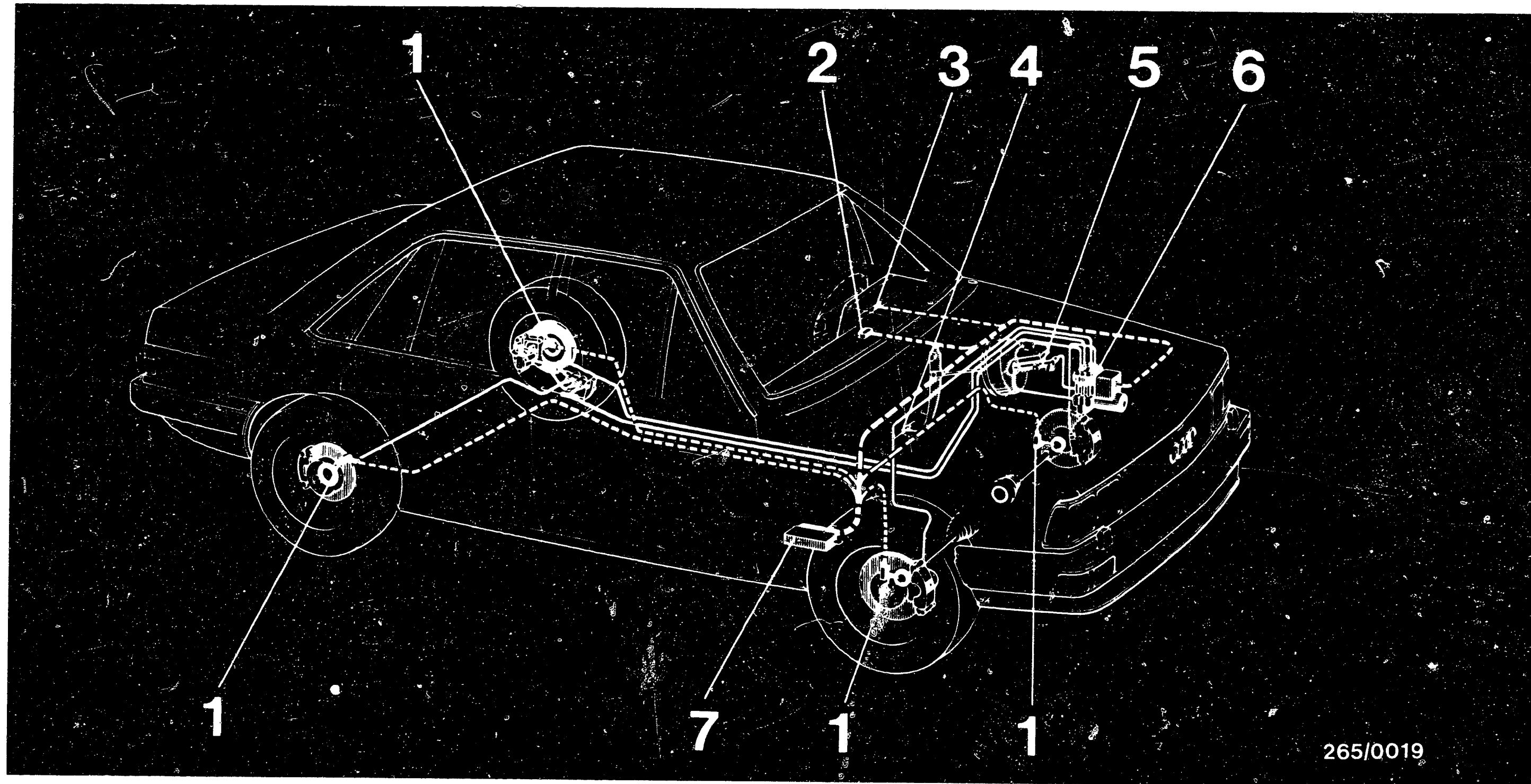
Audi 200 (until 8.83):
On right below glove compartment, attached to controller.

Audi 100 (until 8.83):
Relay position 7

Audi 100 and 200 (as of 9.83):
Relay position 11

*Combination relay:

(Successor relay to over-voltage-protection relay and relay for controller) as of 8.84 for all models:
On auxiliary relay holder on left below switchboard, relay position 5.



265/0019

- 1 = 4 wheel-speed sensors at wheels
- 2 = ABS switch
- 3 = Warning lamp in dashboard
- 4 = Brake pedal
- 5 = Main brake cylinder
- 6 = Hydraulic modulator in eng. comp.

- 7 = Controller:
 Audi 100 and 200 (as of 9.83): Below rear seat on left.
 Audi 200 (until 8.83): Underneath glove compartment.
 Audi 80 and 90 : In trunk on left.

--- = Electrical leads
 ——— = Hydraulic lines

Installation position of components for Audi 100/200 (Audi 80 and 90 similar)

BLEEDING BRAKING SYSTEM

After replacing the hydraulic modulator, it is necessary to bleed the braking system and carry out a high- and low-pressure test.

Exercise caution when working with brake fluid!

- a) Brake fluid should be kept only in containers with which there is no possibility of accidental drinking (C a u t i o n , p o i s o n !)
- b) Even very slight traces of mineral oil will lead to malfunctioning of the braking system. It is particularly important to be careful when working with clear or yellow brake fluid, since the danger of mistaking one for the other is particularly acute. If mineral oil is located or suspected in the braking system, the entire braking system must be thoroughly rinsed with brake fluid. In addition, the main cylinder must be replaced.
- c) Do not allow brake fluid to come into contact with the vehicles's finish, since brake fluid contains components which act as paint solvents.
- d) Brake fluid is very hygroscopic, i.e. it absorbs moisture from the air, resulting in a lowering of its boiling point. For this reason, brake fluid must be stored in well-sealed storage containers.

Note:

In the course of vehicle operation the boiling point of the brake fluid is lowered due to continuous absorption of moisture from the atmosphere.

This can cause formation of vapor pockets in the braking system during heavy braking.

For this reason, the brake fluid must be changed once yearly, in spring if possible.

Bleeding

- * When bleeding with a braking-system bleeder device, observe the operating instructions provided by the manufacturer. In order to remove all air bubbles from the tandem master cylinder, during the bleeding process the brake pedal must be fully depressed at least three times with the bleeder screw open.
- * When bleeding by "pumping" the brake pedal, close the corresponding bleeder screw each time before the brake pedal is returned, so that no air is sucked in through the threads of the bleeder screw.
- * Slowly return the brake pedal so that sufficient brake fluid is suctioned out of the fluid reservoir by the return stroke of the piston.
- * Bleeding is completed when clear, bubble-free brake fluid comes out of the bleeder hose.

I m p o r t a n t !

The brake fluid pumped out during bleeding must not be re-used, since it can contain foreign objects which would in this way re-enter the braking system.

- * Fill the fluid reservoir with brake fluid up to the "Maximum" mark.

BRAKING-SYSTEM LEAK CHECK

	High-pressure test	Low-pressure test
Line test pressure Gauge pressure	50 bar	6 bar
Duration of testing	45 seconds	3 minutes
Pressure drop of set value	4 bar (max.)	1 bar (max.)

N o t e :

The leak test, which must be carried out for both brake circuits, includes a high- and low-pressure test.

High-pressure test

- * Connect pressure tester to a fixed caliper. To do this, unscrew bleeder screw and screw connection fitting in. Then bleed pressure tester.
- * Let engine run at moderate speed and generate the highest possible vacuum by sudden release of the accelerator pedal.
- * Using the brake-pedal-actuating device, push the brake pedal in until a line pressure of 50 bar gauge pressure is generated. Then lock the brake pedal in this position.
- * During the test duration of 45 seconds the pressure drop must not be greater than 4 bar. If a greater pressure drop is found, the leak (main brake cylinder, brake hoses, brakes lines, brake caliper) must be found and eliminated or the hydraulic modulator must be replaced.

Low-pressure test

- * Return the brake-pedal-actuating device until the pressure gauge shows a line pressure of 6 bar guage pressure.
- * During the 3-minute duration of the test, the pressure must not fall more than 1 bar. If a larger pressure drop is found, the leak must be found and eliminated, and the main brake cylinder or hydraulic modulator replaced.

GENERAL INFORMATION

with regard to repair work and the braking system

The ABS is basically maintenance-free; however, when working on vehicles with ABS the following must be taken into account:

1. The plug must be disconnected from the electronic controller prior to welding work with an electric welder.
2. For painting, the electronic controller may be briefly subjected to a maximum temperature of 95° C, and for longer periods (approx. 2 hours) a maximum of 85° C.
3. After replacing the hydraulic modulator, the controller, the wheel-speed sensors, and the wiring harness, as well as after work in which the ABS assemblies are affected (e.g. after accidents), the entire ABS system must be inspected using the tester. Correct routing of the brake lines is vital.
4. After all work on the braking system, it must be bled, and a low- and high-pressure test must be carried out. All connection points must be checked for leakage.
5. If the battery has been removed, after re-installation the battery terminals must be securely tightened to the terminal posts of the battery.
6. No fast chargers may be used to start the engine.
7. Never disconnect the battery from the vehicle electrical system with the engine running.

8. When boost-charging the battery, disconnect it from the vehicle electrical system.
9. Make sure all plug connections of the wiring harness are correctly seated.
10. Never disconnect or connect the wiring-harness plug of the controller while the ignition is on.
11. For reasons of safety, the hydraulic modulator must not be repaired, but may only be completely replaced.

The engine and valve relays are an exception. Both relays may be replaced.

With the exception of the brake-line connections, no screws on the hydraulic modulator may be loosened.

After loosening, it is impossible to re-establish sealing of the brake circuits.

This can be fatal!

OPERATION OF THE ABS WARNING LAMP

The ABS-equipped vehicle is brought to the workshop with one of the following customer complaints:

- * Warning lamp does not light up after switching on the ignition.
- * Warning lamp does not go out after attainment of idle speed.
- * Warning lamp lights up during driving or lights up occasionally.

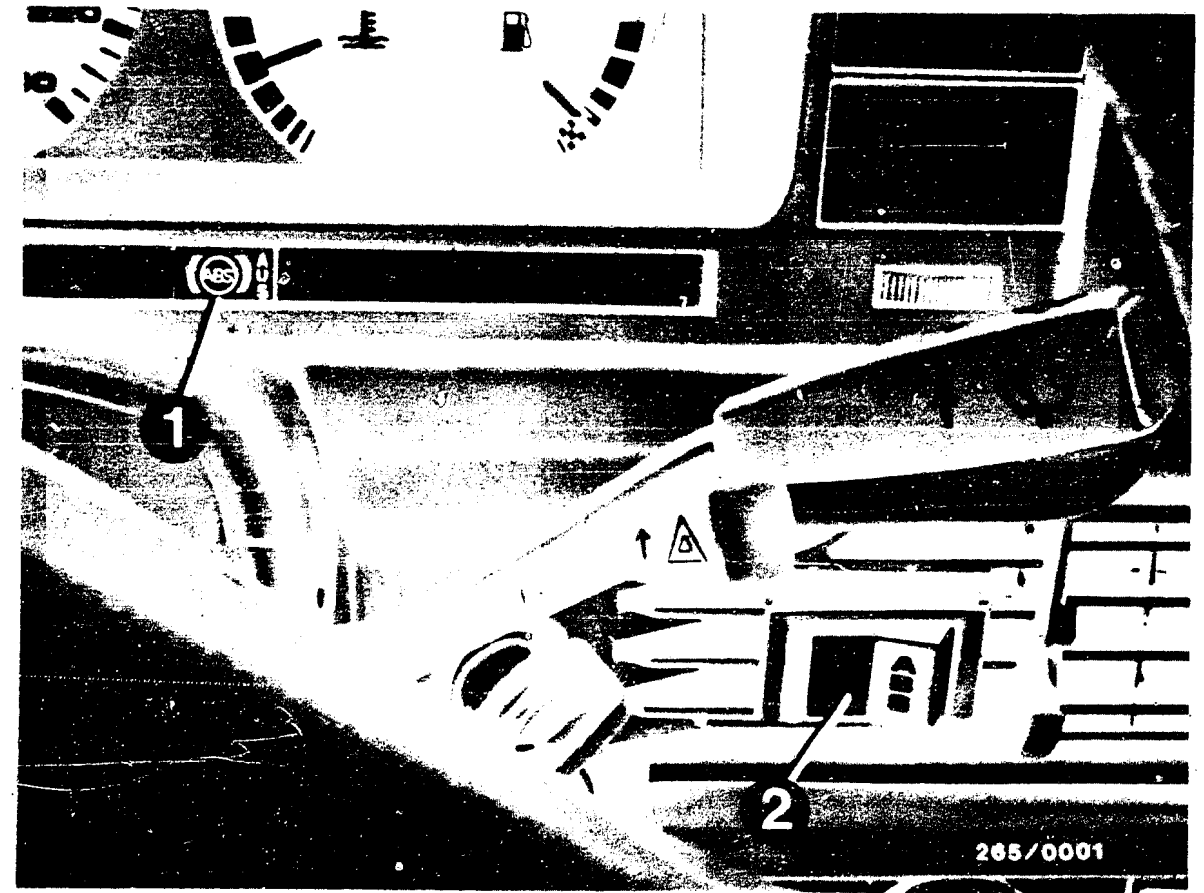
Confirm the existence of the condition before testing the entire ABS system with the ABS tester.

For reasons of safety, the ABS may be tested only with the ABS tester.

The ignition must always be switched off before connecting the ABS tester as well as before disconnecting and connecting the controller.

When you have located a fault with the ABS tester, always disconnect the controller for further trouble-shooting.

Functioning and malfunctioning of the ABS warning lamp will be explained in the following.



1 = ABS warning lamp in Audi 200

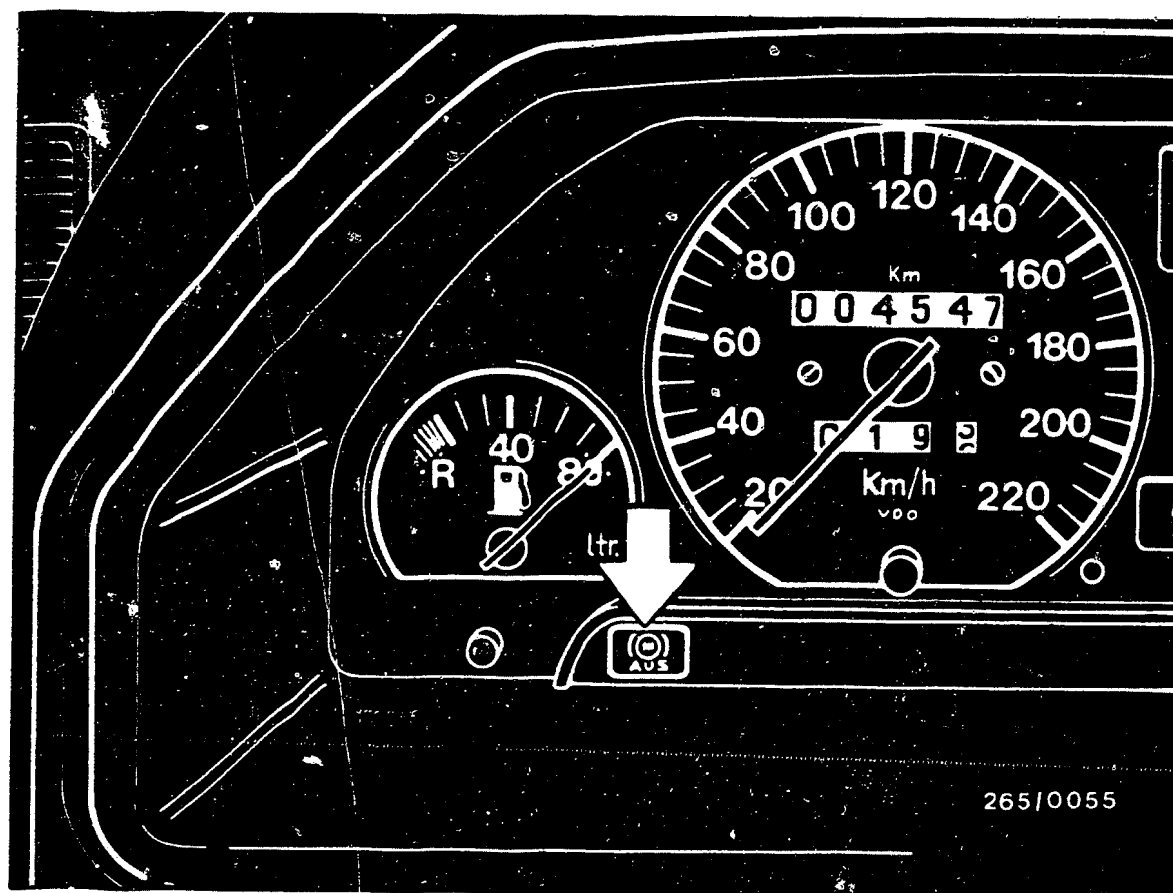
ABS warning lamp

When the ignition is switched on, the warning lamp with the letters "ABS" lights up.

After starting and attainment of idle speed, the ABS warning lamp goes out (terminal 61 from the generator supplies voltage to the ABS controller).

The first time that the vehicle exceeds a speed of approx. 6 km/h (4 mph) with all 4 wheels after starting, the ABS system carries out a self-check (BITE run).

This process is repeated every time the ignition is switched off and the vehicle is subsequently re-started. In addition, the ABS continuously monitors itself to a certain extent during travel.



Arrow = ABS warning lamp
in Audi 100 and Audi 200 (as of 9.83)

Faulty warning-lamp indications are:

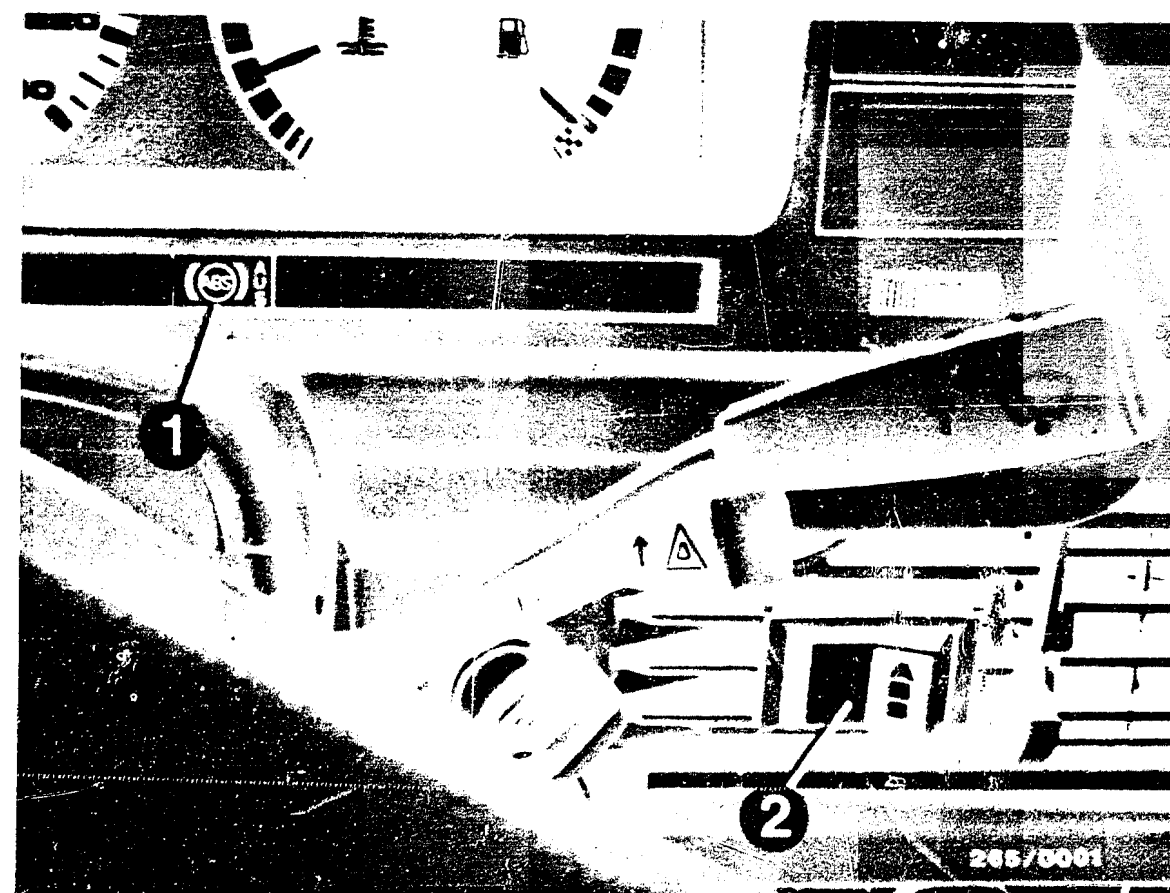
- * Warning lamp fails to light up after the ignition is switched on.
- * Warning lamp fails to go out after idle speed is reached.
- * Warning lamp lights up during travel or lights up occasionally.
(ABS switch switched on!)

Illumination of the ABS warning lamp indicates to the driver that the ABS is not operational.

General information:

Occasional illumination of the warning lamp can be caused by an inadequately charged battery.

The lamp lights up only during conditions of undervoltage, for example when consuming devices are switched on during idle.



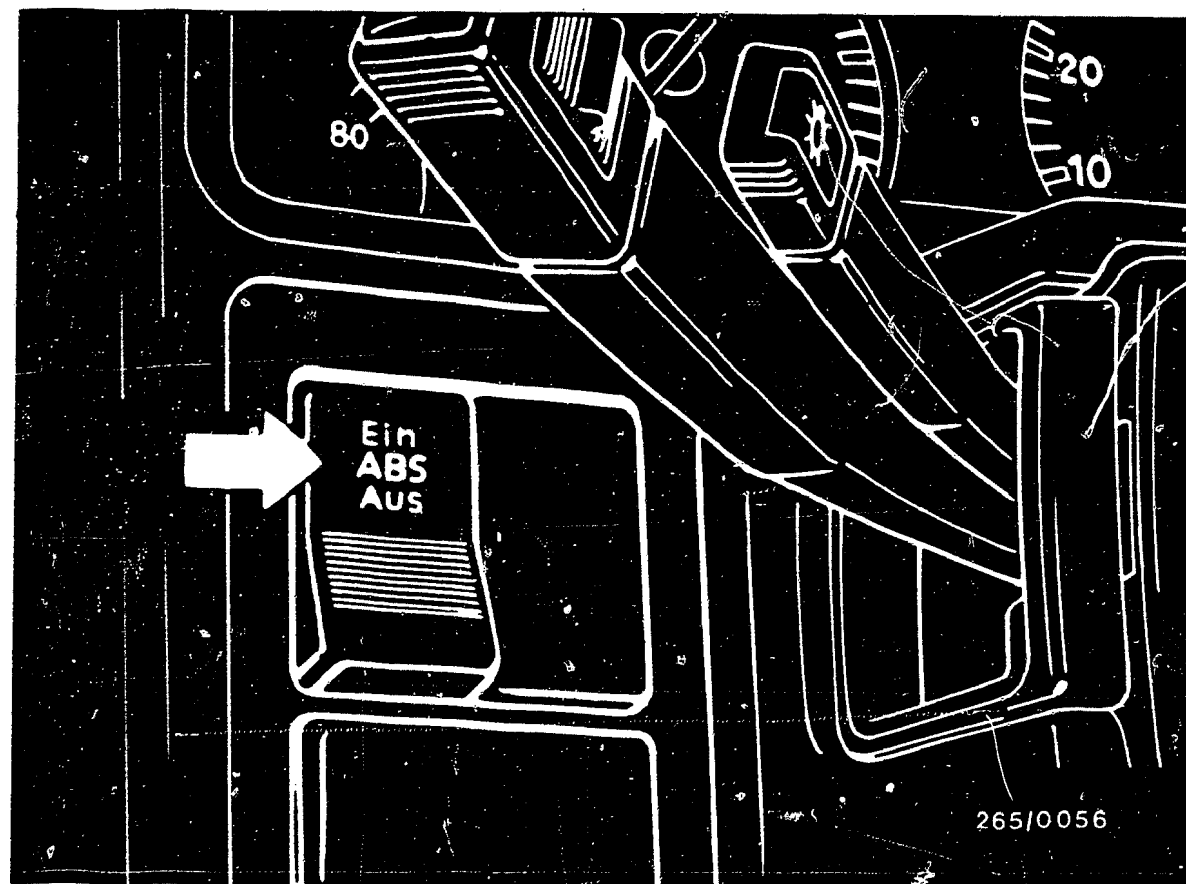
2 = ABS switch in Audi 200

The ABS is then automatically switched off. Nevertheless, braking is still possible with the regular braking system. However, the wheels can block. This is the case both with malfunctions and when the ABS is switched off with the ABS switch.

The causes of trouble should be determined with the help of the ABS tester and a dynamic brake analyzer.

ABS switch

The switch offers the driver the possibility of carrying out tests of the brakes or of road conditions with the goal of intentionally causing the wheels to block.



Arrow = ABS switch
in Audi 100 and Audi 200 (as of 9.83)

In conditions of unusually poor road surface, such as gravel or black ice covered with drifting snow, where driving is possible only with the greatest care and at slow speeds, by switching off the the ABS it may be possible to reduce the braking distance at the price of wheel blockage.

Of course, after returning to normal road conditions, the system should be immediately switched back on with the ABS switch.

I m p o r t a n t !

The electrical system is designed so that every new starting of the engine causes the ABS system to be automatically switched on, regardless of whether the ABS system was switched off prior to turning the engine off.

ABS TESTER

The ABS tester tests functioning of the controller, the hydraulic modulator, the wiring harness, and the components of the antilock braking system (ABS).

With the ABS tester, actual values are found which are compared with the appropriate nominal values.

If the actual-value reading deviates from the prescribed nominal value, trouble-shooting should be carried out in accordance with the information in the "trouble-shooting" column.

The ABS tester should be connected between the controller and the ABS wiring harness (before connecting the tester, switch off the ignition).

Do not drive with the ABS tester connected!

The test steps are set with the program switch (1 through 24).

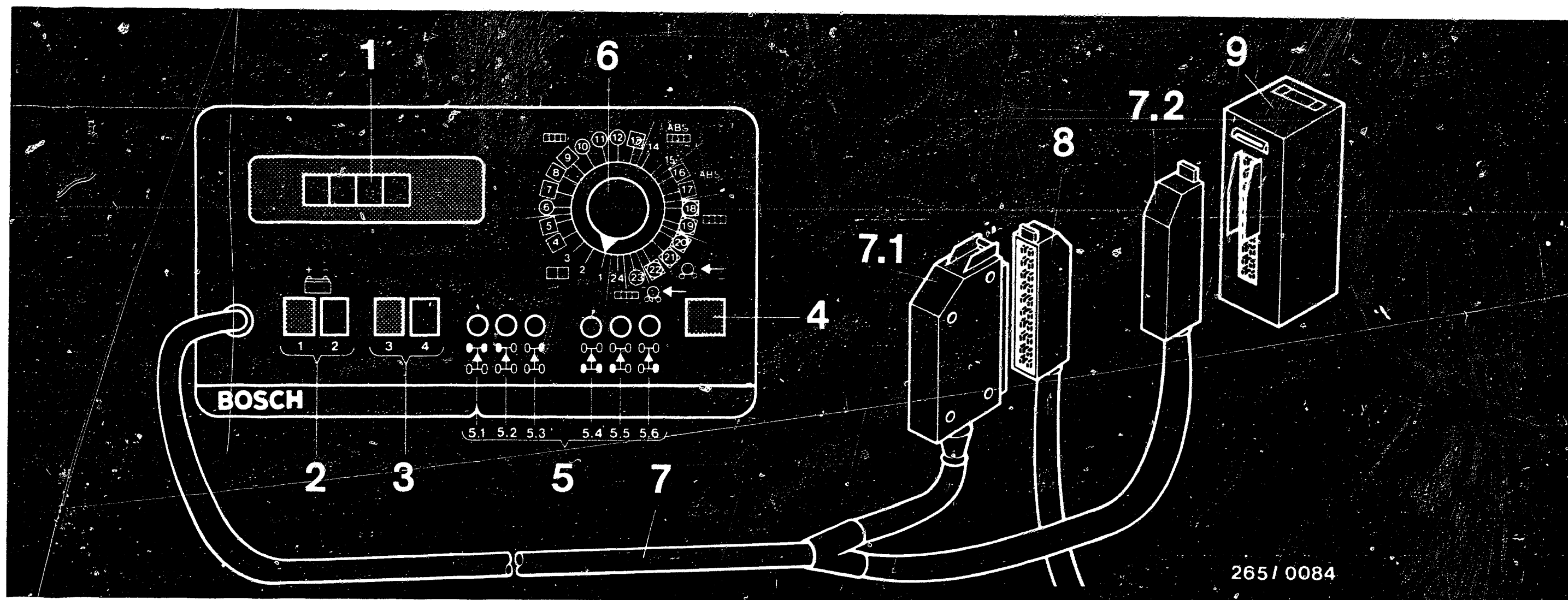
With the wheel-speed sensors and the hydraulic modulator, the round buttons should be pressed according to the test chart.

Test steps requiring large amounts of current are initiated only after the illuminated button is pressed. The illuminated button lights up automatically in the appropriate test steps.

The actual value is indicated either by the green-red lamps or the digital display.

The test steps requiring program-switch positions 20...23 can be carried out only on a dynamic brake analyzer.

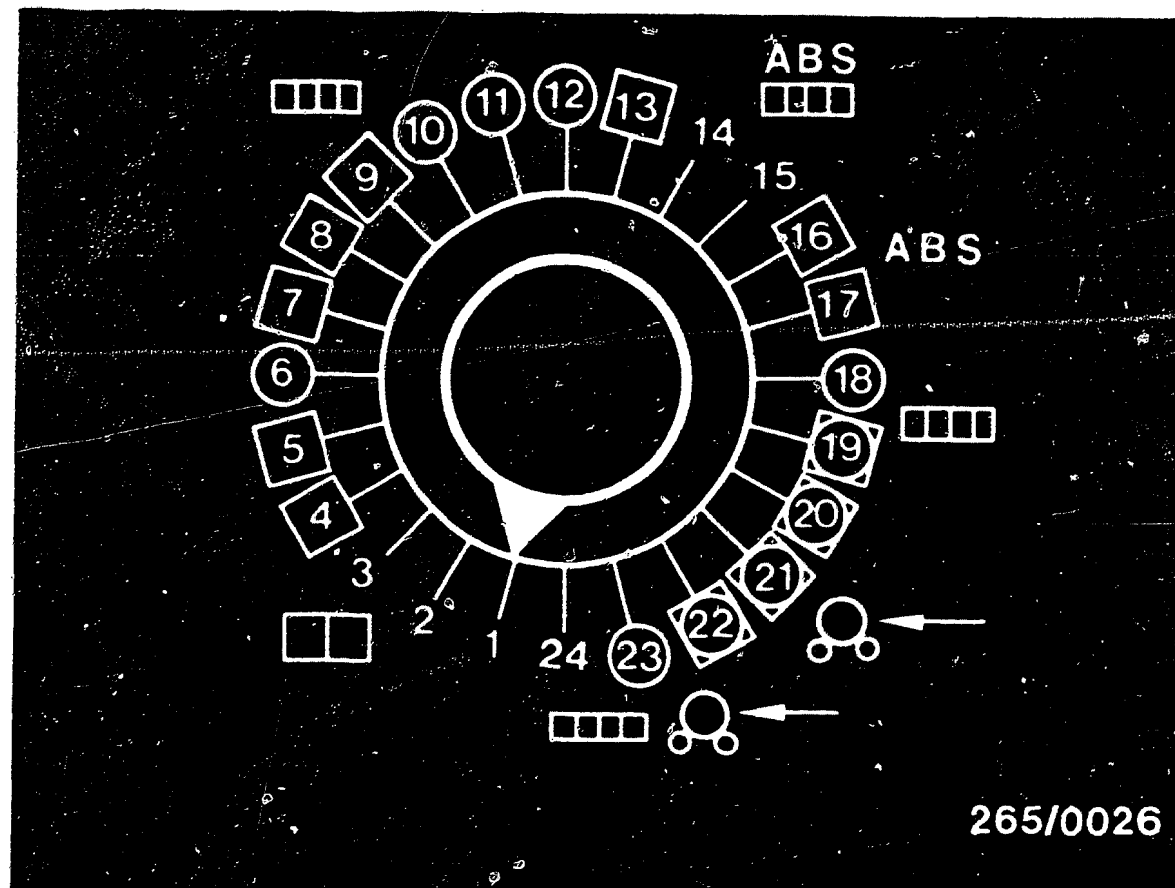
For Generation 2 B the ABS tester must be converted.



- 1 = Digital LED display unit
- 2 = Lamp 1 (green): Battery voltage OK
Lamp 2 (red): Battery voltage too low
- 3 = Lamp 3 (green): Engine and valve relays and over-voltage protection OK
Lamp 4 (red): Engine and valve relays and over-voltage protection defective
- 4 = Illuminated button (yellow), for initiating certain test steps
- 5 = Button for circuit selection (wheel selection)
- 5.1 = Front axle (VA)
- 5.2 = Front left wheel (VL)
- 5.3 = Front right wheel (VR)

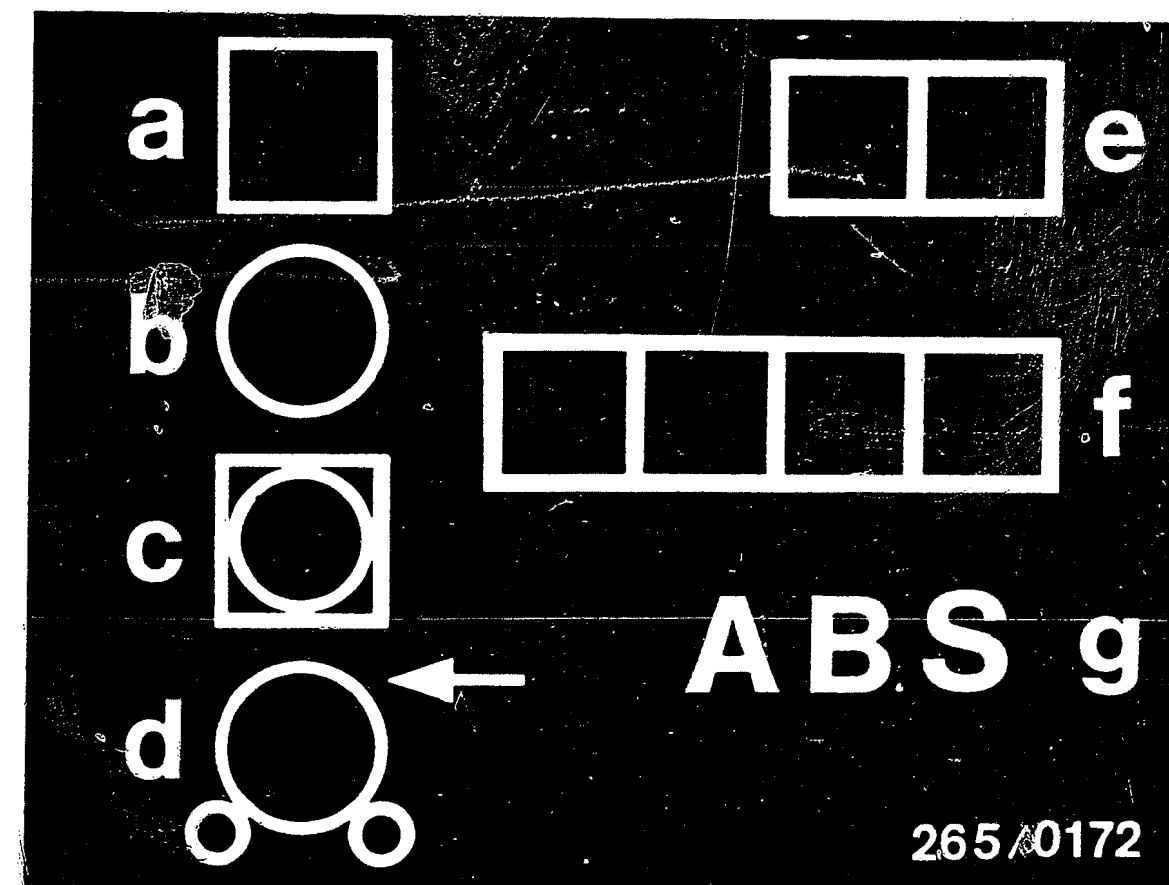
- 5.4 = Rear axle (HA)
- 5.5 = Rear left wheel (HL)
- 5.6 = Rear right wheel (HR)
- 6 = Program switch
- 7 = Connecting cable
- 7.1 = Connection with wiring harness
- 7.2 = Connection with controller
- 8 = Multiple plug from vehicle wiring harness
- 9 = ABS controller (installed in vehicle)

ABS tester



Program switch (description of symbols)

Program switch for 24 program steps



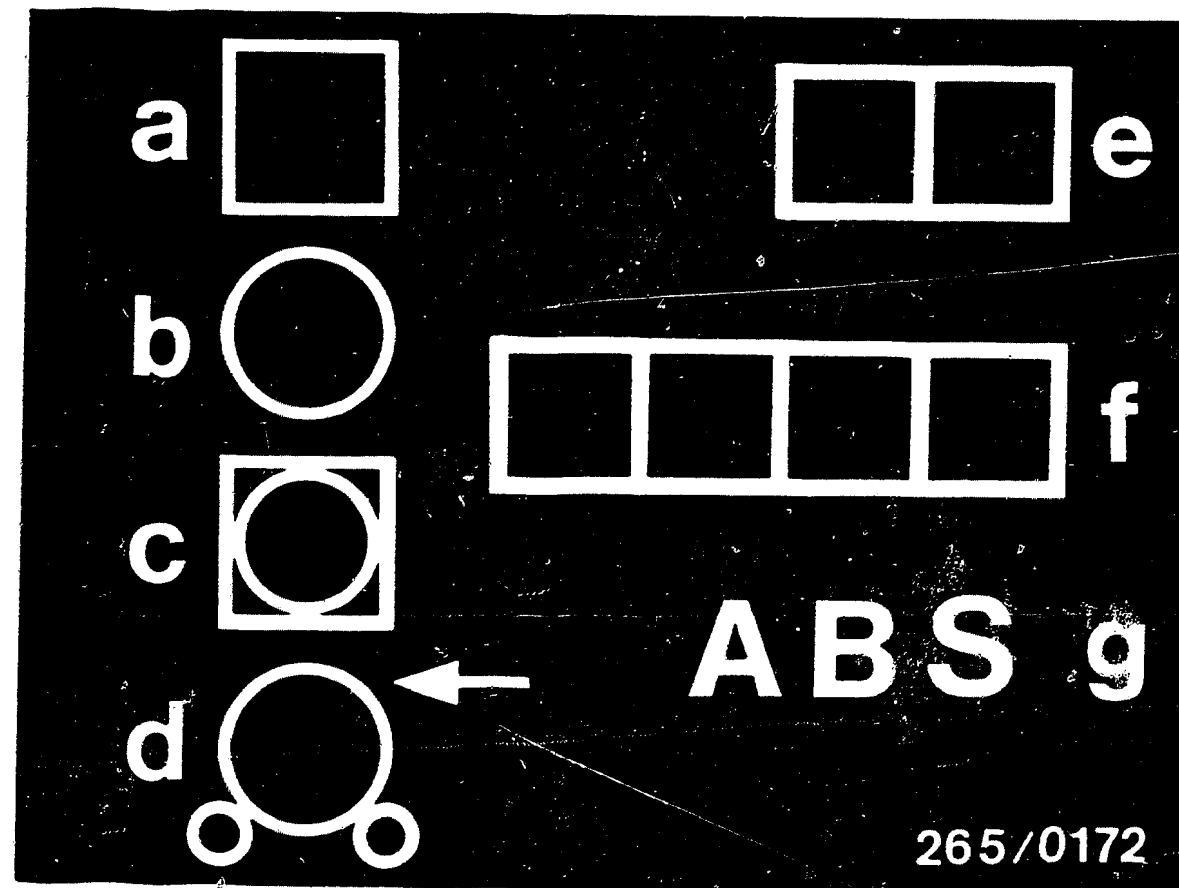
a = Press illuminated button (pos. 4)

b = Press appropriate buttons for circuit selection
(pos. 5.1 through 5.6)

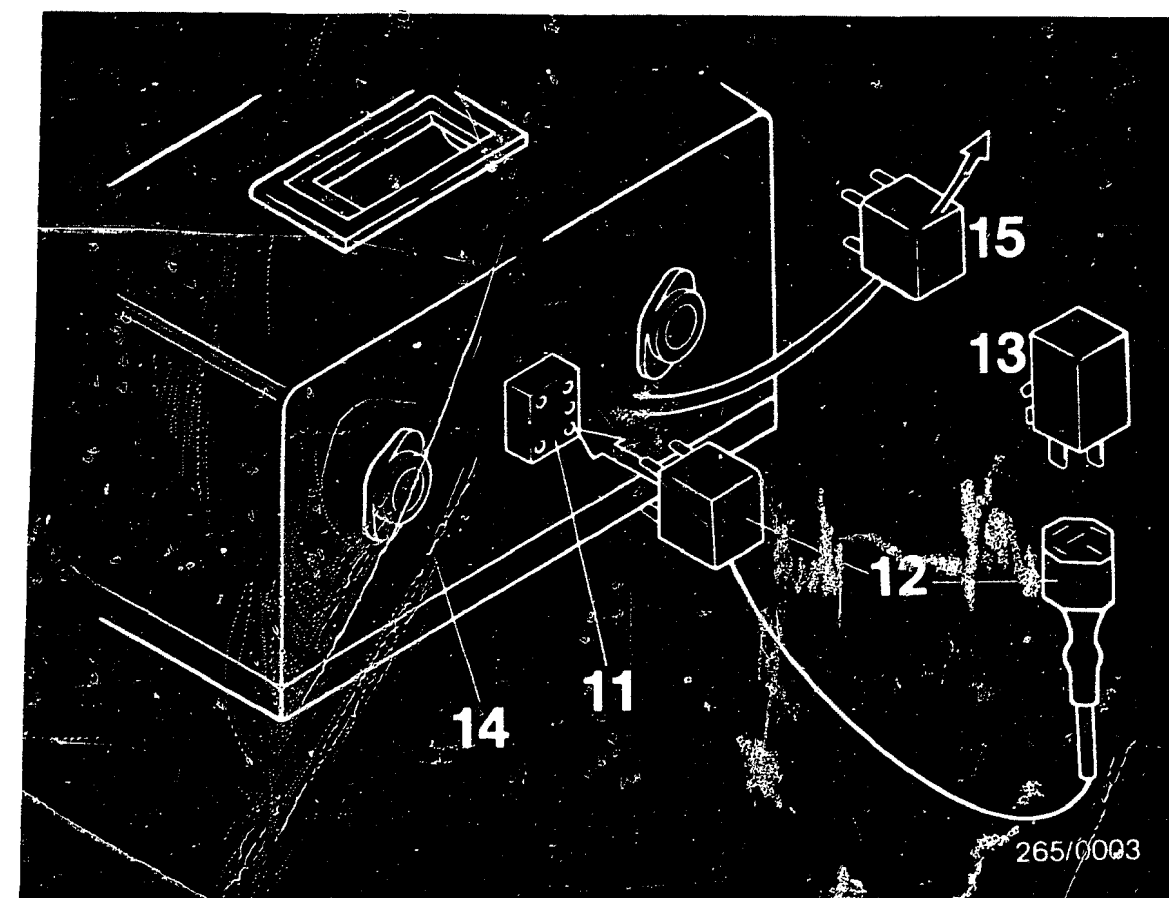
c = Press button for circuit selection
(pos. 5.1 through 5.6).
Press illuminated button (pos. 4)

d = Drive vehicle onto dynamic brake analyzer first with
front and then with rear axle.

Symbols for additional operation



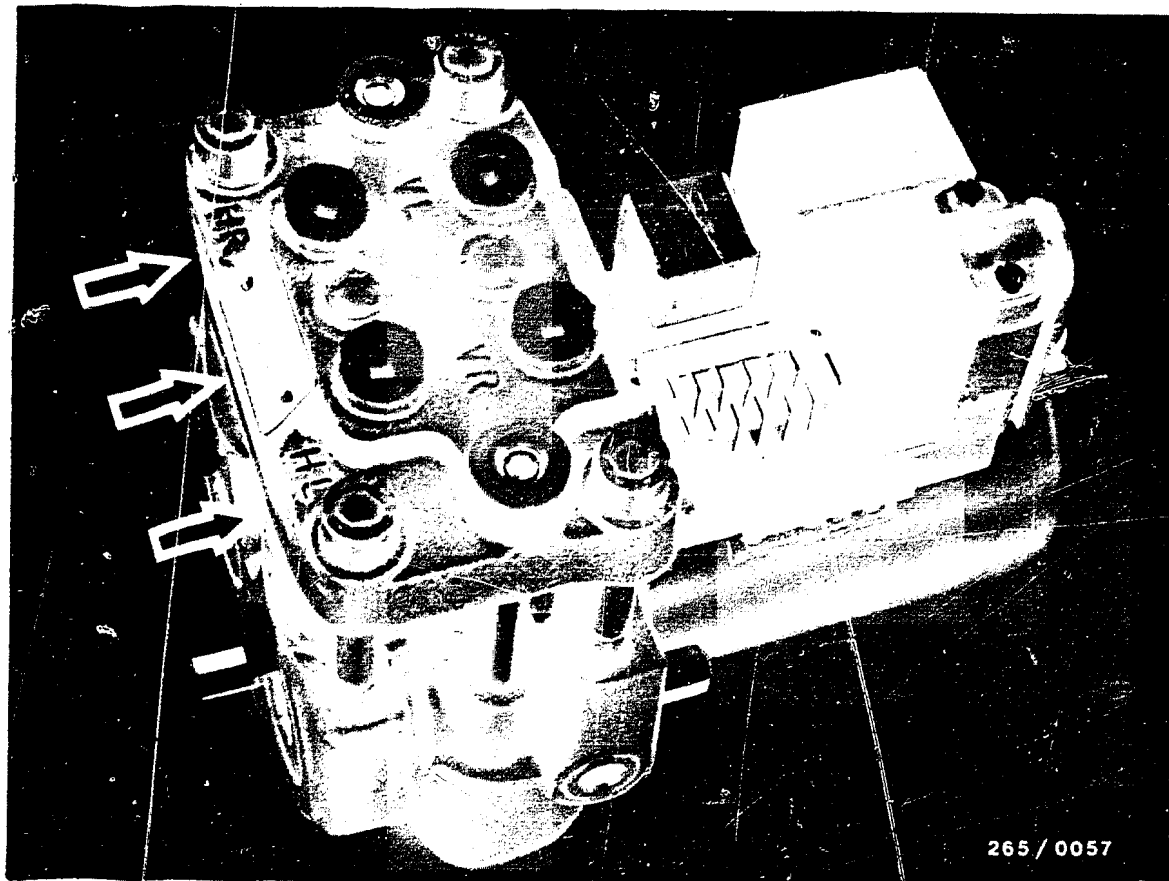
- e = Red-green display,
Lamp units (pos. 2 or 3)
- f = Digital display (pos. 1)
- g = Note warning lamp in vehicle!



- 11 = Plug socket on ABS tester
- 12 = Adapter cable
- 13 = Over-voltage protection relay or combination
relay from the vehicle
- 14 = Rear of tester
- 15 = Over-voltage protection for Daimler-Benz
(remove)

Adapter cable

The adapter cable serves to connect and test the over-voltage protection relay or combination relay at the plug socket on the rear of the tester.

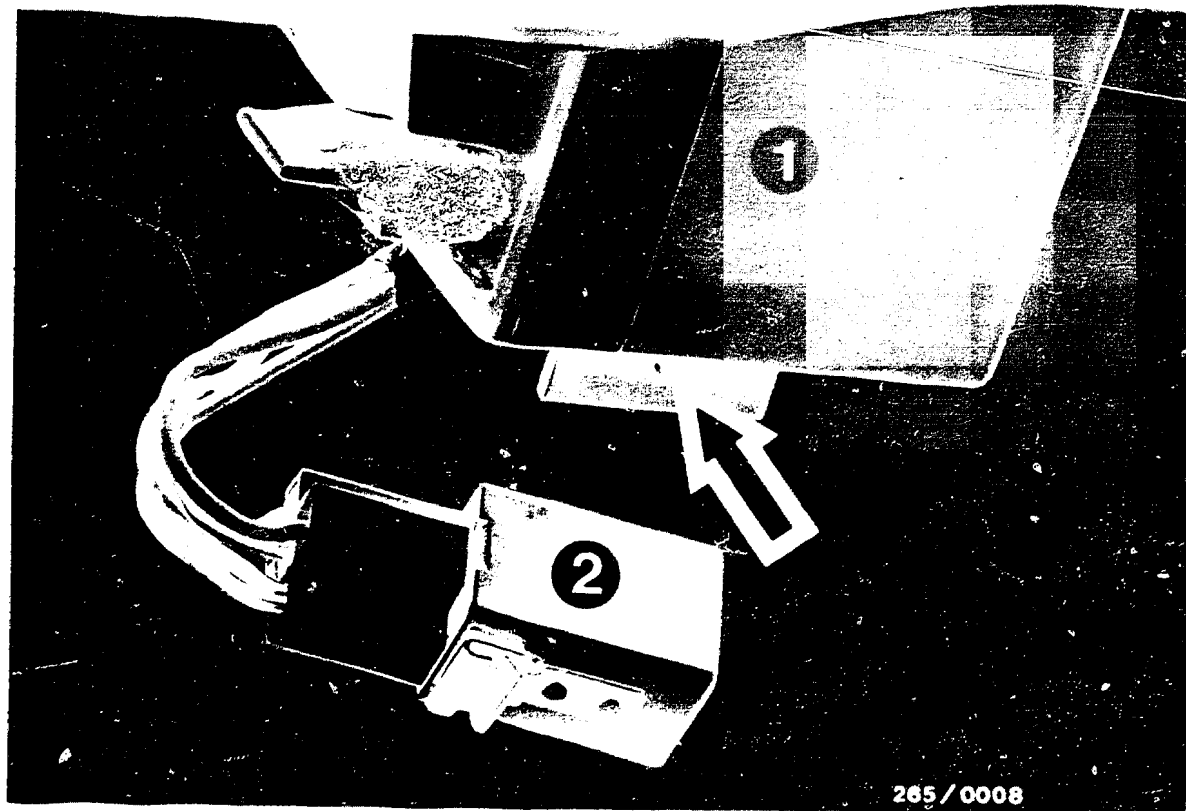


REQUIREMENTS FOR TESTING

Testing with the ABS tester

- * Check return-pump ground connection for secure seating.
- * Check hydraulic connections at hydraulic accumulator for leakage (visual inspection).
Pay particular attention to sealing points (arrows).

- * If the ABS warning lamp temporarily lights up during travel (e.g. after switching on consuming devices) and then goes out again by itself, check the battery and voltage supply (generator, regulator, and voltage drop).
- * If the ABS warning lamp lights up and does not go out, check the following points:
 - > Does the multiple plug on the controller show correct seating and is it engaged?
Are all plug connections OK?
Are spring connections engaged?
 - > Is V-belt torn?
(Generator provides no voltage, charge and ABS warning lamps light up).
 - > Does generator term. 61 provide voltage?
Plug connection and lead to ABS controller OK.
 - > In program-switch position 10, pay particular attention to checking for loose contacts for the wheel-speed sensors.



- 1 = Controller in Audi 200 (until 8.83)
 2 = Over-voltage-protection relay
 in Audi 200 (until 8.83)

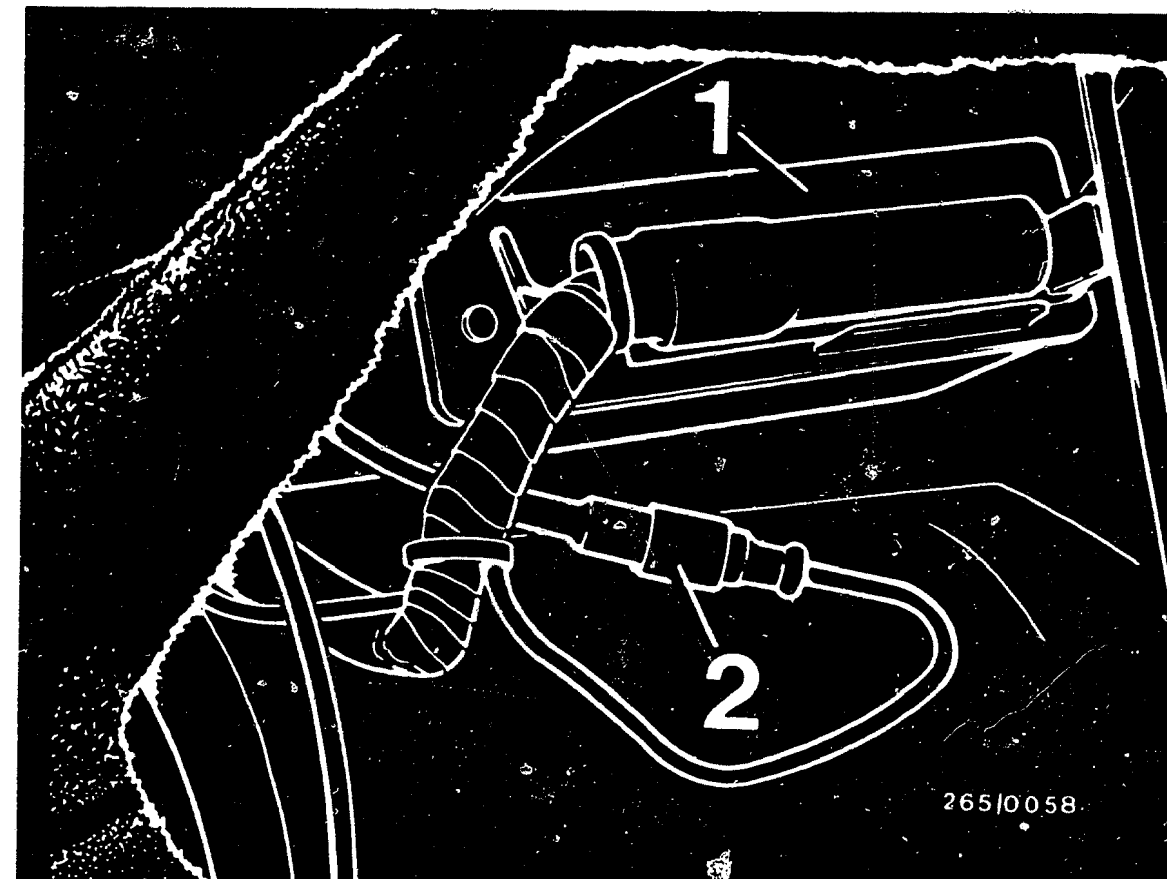
* Connect ABS tester to controller and ABS wiring harness.

I m p o r t a n t ! Connect and disconnect controller only with the ignition switched off. Controllers of Generation 2 B (in some cases with green sticker) may be installed in vehicles including those built before 9.83. Controllers of Generation 2 may only be installed in vehicles made before 8.83.

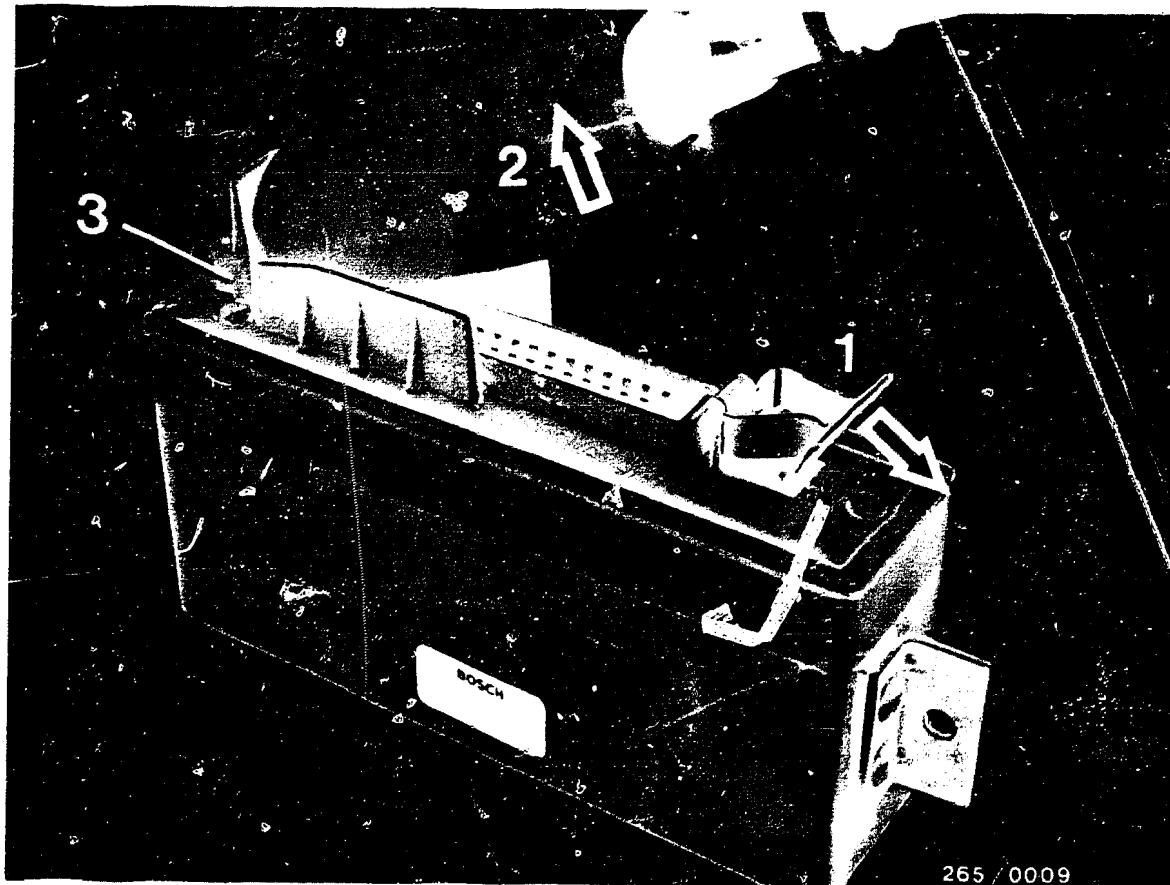
Connection of the ABS tester:

The installation point in the Audi 200 (until 8.83) is on the right below the glove compartment, and in the Audi 100 and Audi 200 (as of 9.83) on the left under the rear seat.

In the Audi 80 and 90, it is on the left in the trunk. For removal, if controller is under glove compartment, unscrew stowage compartment under glove compartment. Loosen fastening screw (arrow). The second screw is accessible through the glove compartment.



- 1 = Controller
 in Audi 100 and 200 (as of 9.83)
 2 = Wheel-speed-sensor plug connections
 in Audi 100 and 200 (as of 9.83)



- 1 = Spring
- 2 = Multi-pin plug (35-pin)
- 3 = Encoding unit

Switch off ignition prior to disconnection of multiple plug.

Press back spring, hinge multiple plug up, and disengage from encoding unit.

* For testing with the tester, switch on the ignition in all program-switch positions (tester uses current from vehicles battery).

* Observe tester lamps 1 and 2 in all program-switch positions.

I M P O R T A N T !

Do not drive with tester connected!

The entire test program should be repeated after every repair.

General trouble-shooting information

Test all leads for ground connection and contact with positive leads, as well as for abrasion and pinching.

TEST CHART FOR ABS TESTER

N o t e :

In the following test steps, the boxed-in texts indicate which operation is different from that of the preceding test step.

For production reasons:
continued on the following
coordinate.

TEST STEP 1

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Monitoring of voltage supply for controller in all program-switch positions.
This test step must be taken into account during all following test steps, i.e. lamps 1 and 2 must be observed during the entire testing process.

Operation:

Program-switch positions
1 through 24

Operation in vehicle:

Switch on ignition

Test specifications (reading):

Lamp 1 (green) must light up and stay lit.

Note:

Lamp 1 (green) = OK
Lamp 2 (red) = defect
Occasional illumination of lamp 2 (red) = defect

1. Is reading present?
2. Does green lamp 1 light up and stay lit?

N>

Trouble-shooting:

Switch off ignition prior to disconnecting or connecting the controller. Use circuit diagram when necessary.

1. No reading:

- * Controller plug not correctly connected.
- * Plug-in fuse in combination relay (as of 8.84) defective.
- * Fuse for term. 15 defective.
- * Over-voltage-protection relay or combination relay defective.
- * ABS defective.
- * Relay for controller defective.

Check following leads:

- * Positive lead from to over-voltage-protection relay term. B+ or combination relay term. 30 .
- * Negative lead from over-voltage-protection relay term. 30(2) or combination relay term. 31 to ground terminal behind switchboard.
- * Negative lead from over-voltage-protection relay term. 31(4) (if present) to multiple plug term. 31b .
- * Ground terminals must be bare metal and must show no contact resistance.



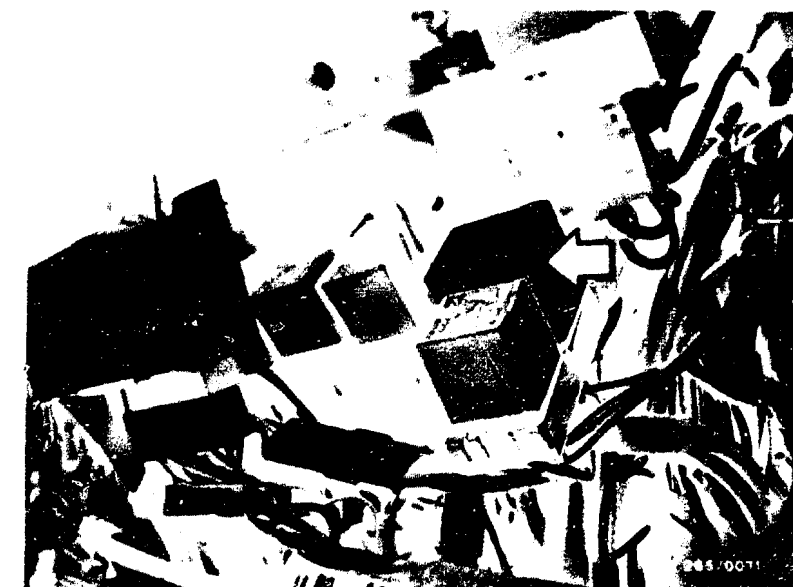
In Audi 200 (until 8.83):

1 = Controller

2 = Over-volt.-protect. relay

In Audi 200 (until 8.83):

Arrow = Relay for controller



Continued on next coordinate

Continued on next coordinate

C03

<==>

C04

<==>

TEST STEP 1 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

- * Positive lead from over-voltage-protection relay term.30a or combination relay term.87(6) to multiple plug term.1.
- * Positive lead from over-voltage-protection relay term. 86 to relay for controller term.87.
- * Positive lead from relay for controller term.30 or combination relay term.15(5) to driving switch term.15.
- * Positive lead from relay for controller term.86 or combination relay term.T(8) to ABS switch term.5 or term.2.
- * Lead from relay for controller term.86a to starting motor term.50.
- * Positive lead from ABS switch term.4 or term.1 to driving switch term.15.

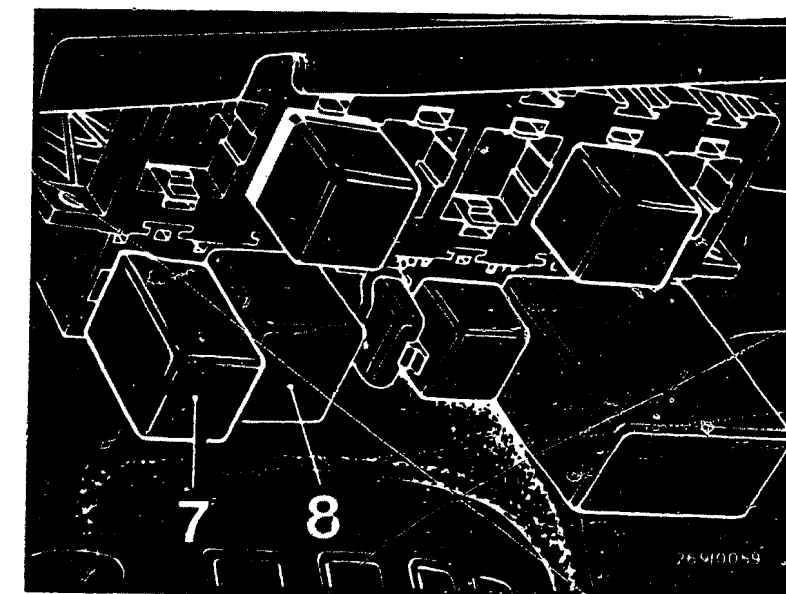
Continued on next coordinate

Continued on next coordinate

C05



C06



Audi 100 (until 8.83).

7 = Over-voltage-protection relay

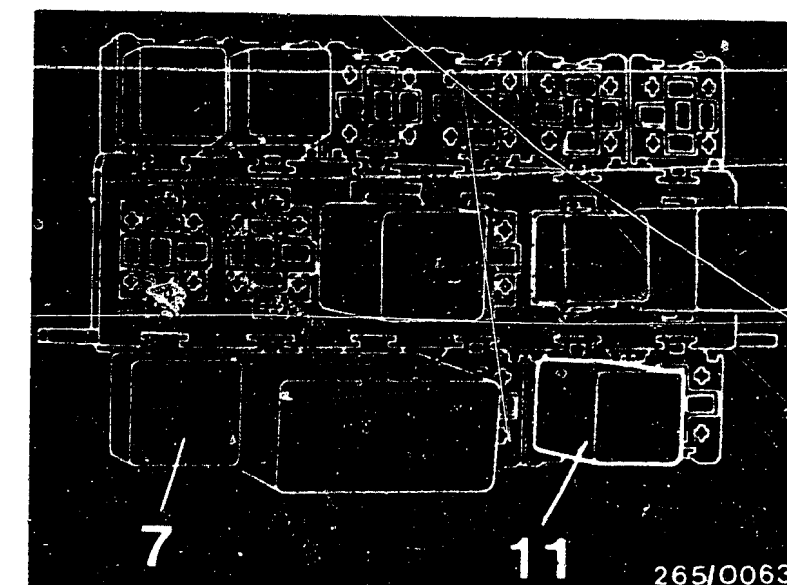
8 = Relay for controller

Audi 100 and 200

(from 9.83 until 8.84):

7 = Relay for controller

11 = Over-voltage-protection relay



265/0063

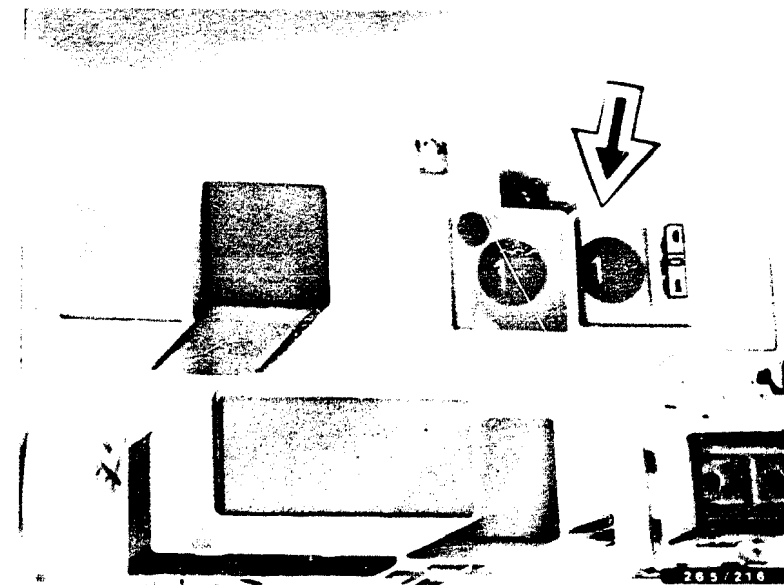
TEST STEP 1 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

2. Lamp 2 (red) lights up
or lights up briefly during
testing process:
Interrupt testing and eliminate
source of trouble

Sources of trouble:

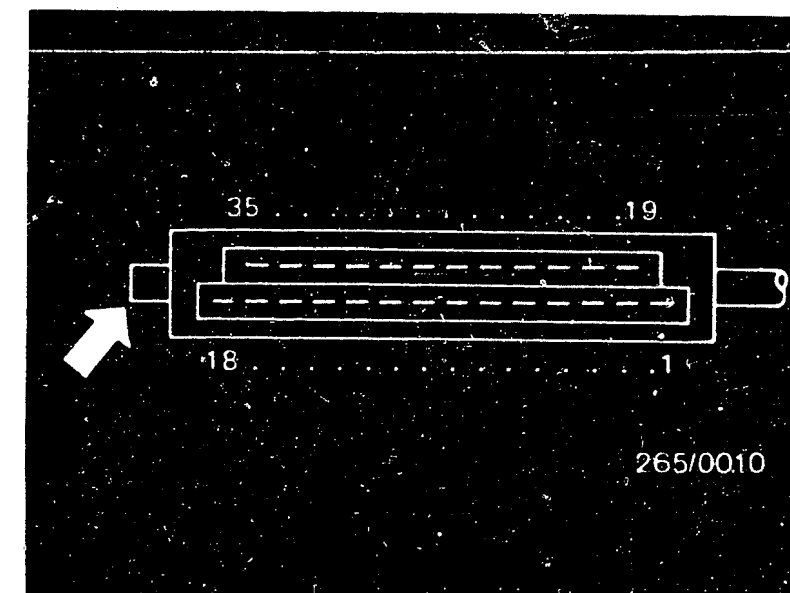
1. Battery insufficiently charged.
Charge battery or let engine run.
2. Excessive voltage drops at ground
terminals:
Ground terminals must be bare
metal.

After eliminating faults, carry out
complete test program.



All models as of 8.84:
Arrow = Combination relay
relay position 5

Top view of multiple plug
K1 (35-pin) with terminal
numbers.
Arrow = Lug with mechanical
encoding



Continued on next coordinate

TEST STEP 2

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Valve relay - contact in inoperated position

N>

Operation:
Program-switch
position

1

Operation in vehicle:

Switch on ignition.

Test specification (reading):

Lamp 1 (green) and
lamp 3 (green)
must light up.

Do lamps 1 and 3 light up?

Trouble-shooting:
(switch off ignition).

Lamp 4 (red) lights up:

- * Valve relay defective.
Important!
Use only relay with correct
electrical terminal assignment.
- * Ground connection shows excessive
contact resistance or is
interrupted.
- * Test the following leads for
continuity:

From ground to plug K3/ term. 8.

From K4/ term. 8 to valve relay
term. 87a.

From K4/ term. 12 to valve-relay
plug term. 30.

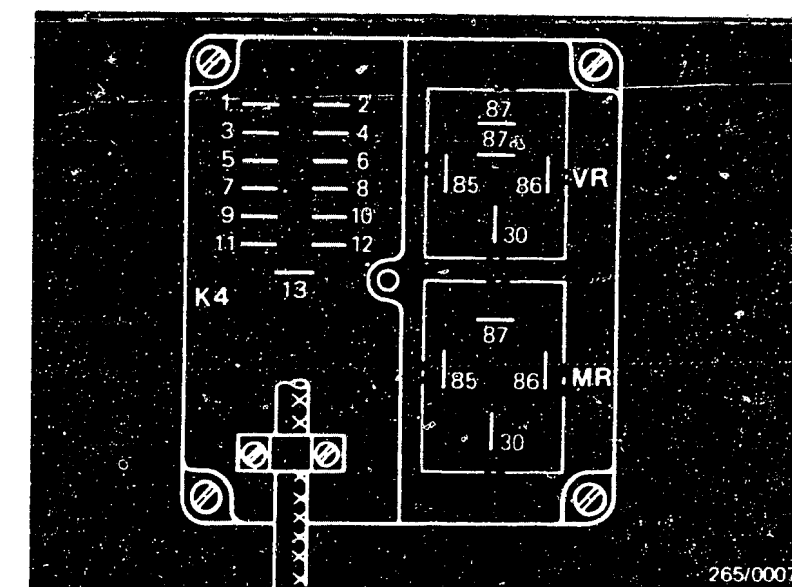
From K3/ term. 12 to multiple
plug K1/ term 32.



3 = Hydraulic modulator

Top view of plug-in printed-board
assembly for hydraulic modulator.
Position of terminals:

VR = Valve relay
MR = Motor relay
K4 = Wiring-harness plug



Continued on next coordinate

C09

<=>

C10

<=>

TEST STEP 3

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Valve relay - normally-open contact N>

Operation:

Program-switch position

1 2

Operation in vehicle:

Switch on ignition

Test specification (reading):

Lamp 1 (green) and
lamp 3 (green) must light up.

Do lamps 1 and 3 light up?

Trouble-shooting

(Switch off ignition):

Lamp 4 (red) lights up:

* Valve relay defective.
Important!
Use only relay with correct
electrical terminal assignments.

* Test the following leads for
continuity:

From term.B+ to plug K3/
term.4.

From K4/term.4 to valve
relay term.87.

From K3/ term.6 to multiple
plug K1/term.27.

From K4/ term.6 to valve relay
term.85.

From valve relay term. 86 to
engine relay term.86.

From engine relay term.86 to K4/
term. 2.

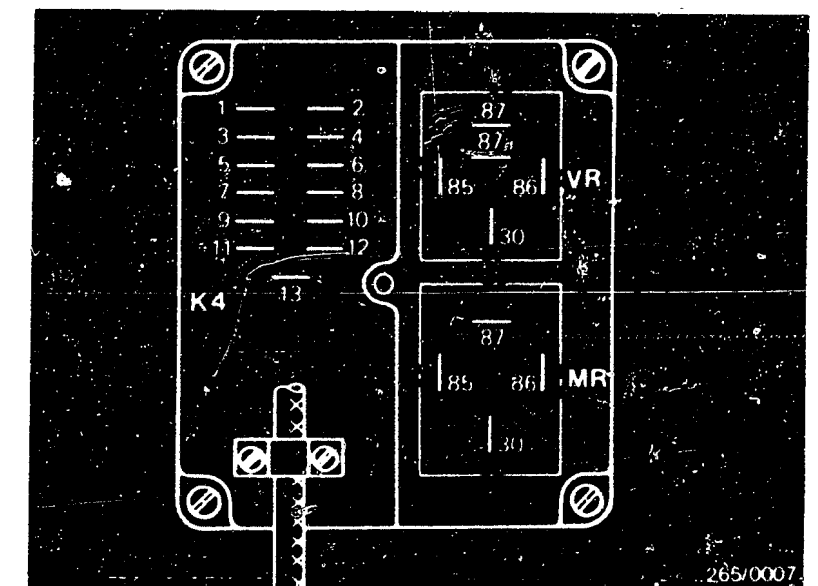
From 2/term.K3 to over-voltage-
protection relay term.2 or
combination relay term.30a.



3 = Hydraulic modulator

Top view of plug-in printed-board
assembly for hydraulic modulator.
Position of terminals:

VR = Valve relay
MR = Motor relay
K4 = Wiring-harness plug



Continued on next coordinate

C11

C12

TEST STEP 4

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Motor relay - contact in inoperated position

N>

Operation:

Program-switch position

1 3

Operation in vehicle:

Switch on ignition

Test specification (reading):

Lamp 1 (green) and lamp 3 (green) must light up.

Do lamps 1 and 3 light up?

Trouble-shooting

(Switch off ignition)

Lamp 4 (red) lights up:

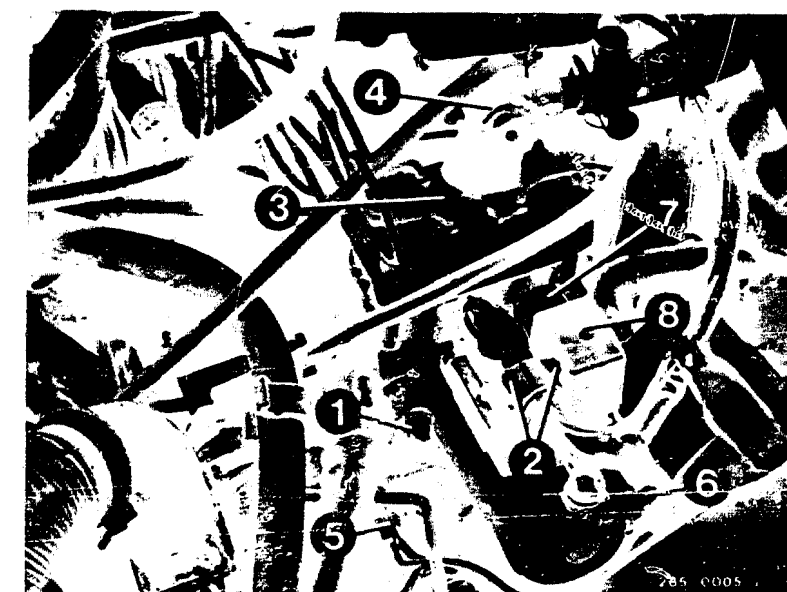
- * Motor relay defective.
- * Check pump-motor ground terminals for firm seating and contact resistance.

- * Test following leads for continuity:

From multiple plug K1/term.14 to plug K3/term.9.

From K4/term.9 to engine relay term. 30 and to the pump-motor positive connection.

- * Test pump-motor positive connection for firm seating. Test pump motor for continuity. If no continuity is measurable, continue testing with test step 5.



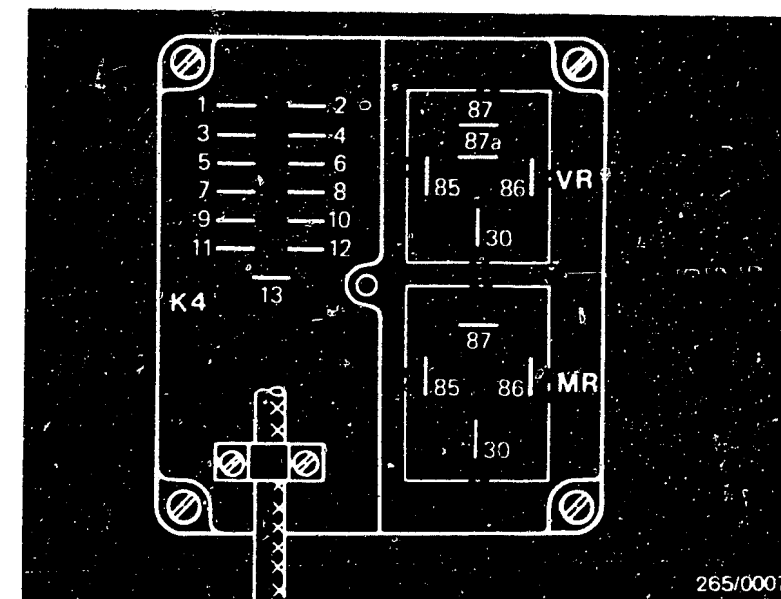
8 = Engine relay

Top view of plug-in printed-board assembly for hydraulic modulator. Position of terminals:

VR = Valve relay

MR = Motor relay

K4 = Wiring-harness plug



Continued on next coordinate

C13

C14

TEST STEP 5

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Motor relay - normally-open contact

N>

Operation:

Program-switch position illuminated button lights up, press button.

4

Operation in vehicle:

Switch on ignition.

Test specification (reading):

Lamp 1 (green) and lamp 3 (green) must light up.

Do lamps 1 and 3 light up ?

Trouble-shooting

(Switch off ignition).

Lamp 4 (red) lights up:

*Motor relay defective.

*Test following leads for continuity:

From motor relay term. 85 to K4/term. 11.

From K3/term. 11 to multiple plug K1/term. 28.

From motor relay term. 87 to K4/term. 13.

From K3/term. 13 to term. B+.

*Pump motor not running :
Continue testing with test step 6.



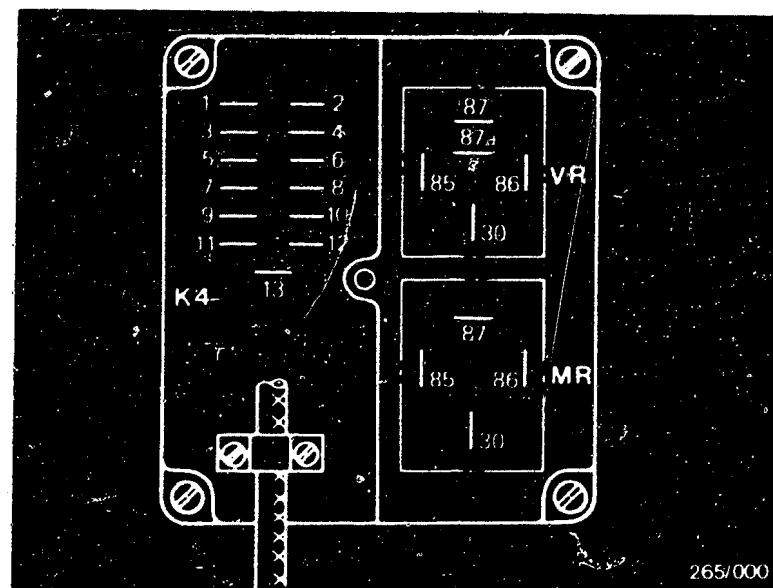
8 = Engine relay

Top view of plug-in printed-board assembly for hydraulic modulator. Position of terminals:

VR = Valve relay

MR = Motor relay

K4 = Wiring-harness plug



Continued on next coordinate

C15

<=>

C16

<=>

Component/Function:

Over-voltage-protection relay or combination relay test of fuse and Zener diode.

N>

Operation:

Program-switch position : 5

Switch off ignition, disconnect controller.

Plug over-voltage-protection relay or combination relay of vehicle into test plug on rear of tester using adapter cable. Plug a new over-voltage-protection relay or combination relay into the vehicle.

Operation in vehicle:

Switch on ignition and wait about 1 s, then press illuminated button (lights up).

Test specification (reading):

Lamp 1 (green) and lamp 3 (green) must light up.

Do lamps 1 and 3 light up ?

Continued on next coordinate

Trouble-shooting:

1. Is the correct relay (identical type) plugged in in the vehicle ?
2. Repeat test step.
3. The over-voltage-protection relay or combination relay connected to the adapter cable is defective.

Installation position of components:

Installation position in the Audi 100 and 200 (from 9.83):

Relay location 7 =

Relay for controller.

Relay location 11 =

Over-voltage-protection relay

Installation position from 8.84

in all Audi models:

Relay location 5 =

Combination relay.



In Audi 200 (until 8.83):

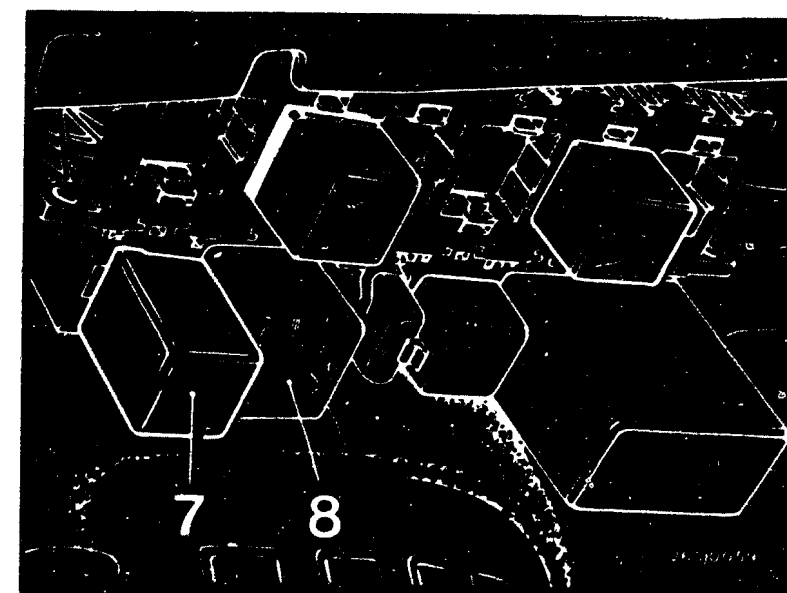
1 = Controller

2 = Over-volt.-protect. relay

Audi 100 (until 8.83).

7 = Over-voltage-protection relay

8 = Relay for controller



Component/Function:

Hydraulic modulator.
Internal resistance of the
solenoid-operated valves.

N>

Operation:

Program-switch position: 6

Press the following buttons
in sequence and note digital
reading after pressing each
button.

1. Press button VL
2. Press button VR
3. Press button HL
4. Press button HR

Operation in vehicle:

Switch on ignition.

Test specifications (readings):

1. VL: 0,7...1,7 Ω
2. VR: 0,7...1,7 Ω
3. HL: 0,7...1,7 Ω
4. HR: 0,7...1,7 Ω

Are the measured values within the
permissible test-specification
range?

Continued C27

Trouble-shooting:
(Switch off ignition)1. Measure internal resistance
directly at hydraulic modulator:

- *Valve VL between K4/term.1 and K4/term.12
- *Valve VR between K4/term.3 and K4/term.12
- *Valve HL between K4/term.5 and K4/term.12
- *Valve HR between K4/term.7 and K4/term.12

Nominal value not reached:
Exchange hydraulic modulator.

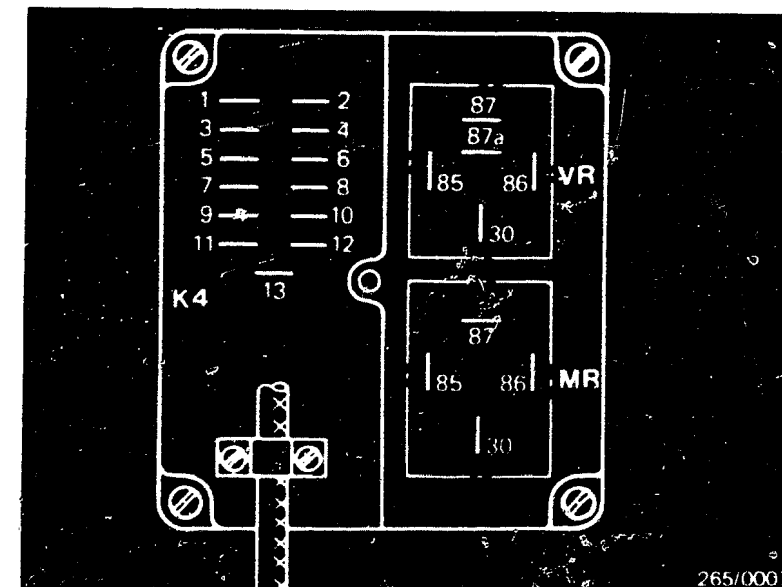
2. Test leads for continuity
(nominal value 0 Ω):

- *Valve VL between K3/term.1 and multiple plug K1/term.2
- *Valve VR between K3/term.3 and multiple plug K1/term.35
- *Valve HL between K3/term.5 and multiple plug K1/term.18
- *Valve HR between K3/term.7 and multiple plug K1/term.19

In case of open circuit:

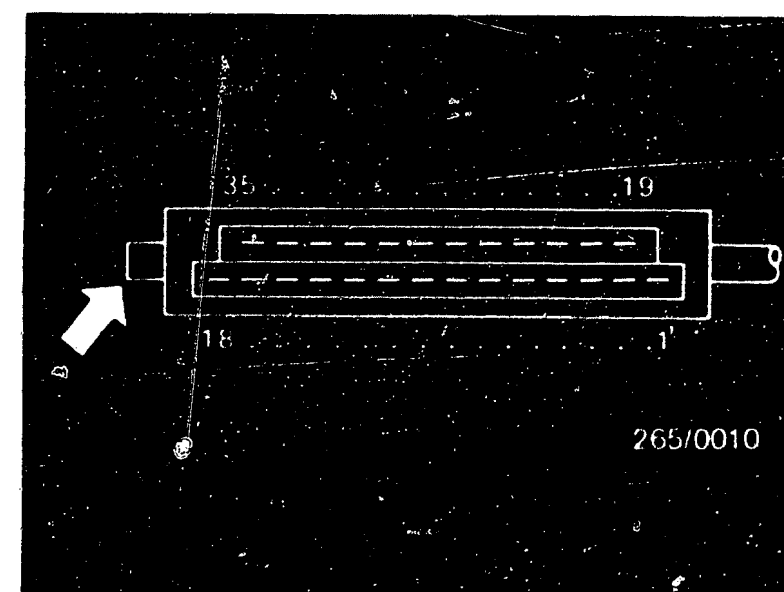
- *Check plug connections.
- *Eliminate open circuit.

Continued on next coordinate



Top view of plug-in printed-board
assembly for hydraulic modulator.
Position of terminals:
VR = Valve relay
MR = Motor relay
K4 = Wiring-harness plug

Top view of multiple plug
K1 (35-pin) with terminal
numbers.
Arrow = Lug with mechanical
encoding



Removing the hydraulic modulator:

- * For reasons of safety, the hydraulic modulator must not be repaired, but may only be completely replaced.

This does not include the motor and valve relay. Both relays may be replaced.

- * Except for the brake-line connections, no bolts on the hydraulic modulator may be loosened.

In particular, the Allen-head bolts (arrows) must on no account be loosened.

After loosening, the brake circuits can no longer be sealed!
This can be fatal!

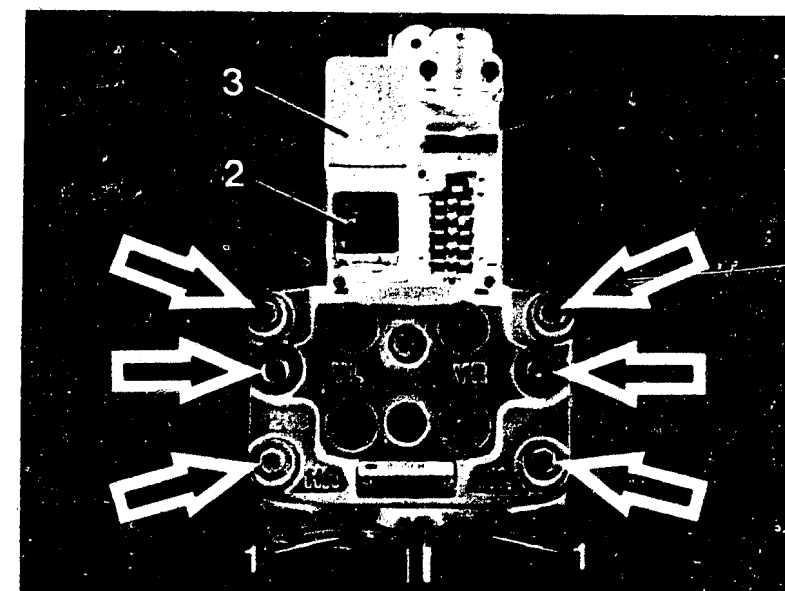
- * Visually inspect the hydraulic modulator and brake-line connections for leakage points.

If brake fluid is escaping, tighten (12...16 Nm) or replace the brake-line connections or install a new hydraulic modulator.



3 = Hydraulic modulator

- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Motor relay



Continued on next microimage

TEST STEP 7 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

Pay particular attention to the sealing points designated with arrows (illustration):

A ventilation hole to the pump plungers is located on the floor of the hydraulic pump modulator.

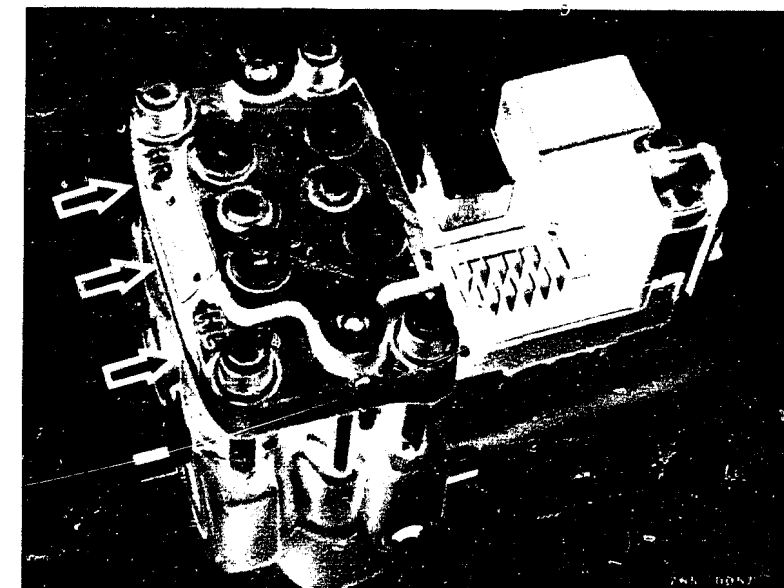
Slight leakage of brake fluid is possible at this point.

A complaint in this regard is justified only when a puddle of brake fluid forms underneath the hydraulic modulator after the brake pedal is operated several times.

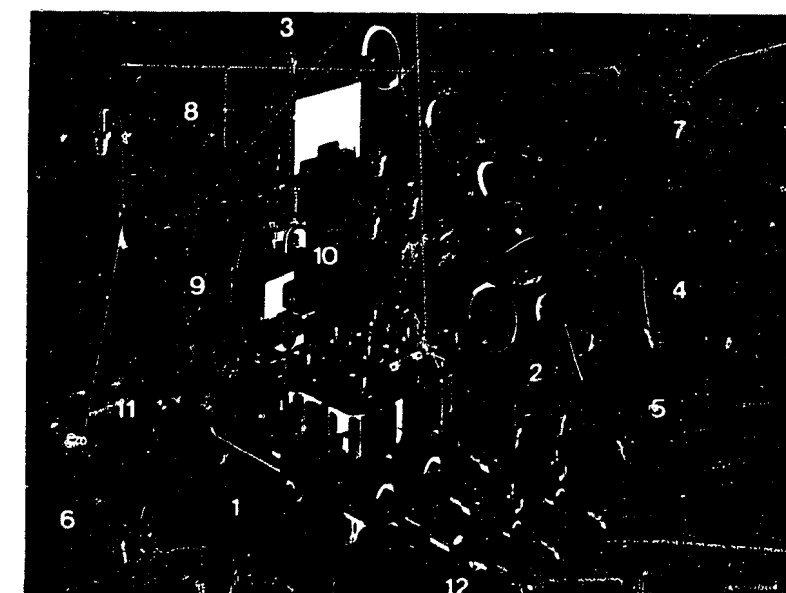
* When removing and installing the brake linings, make sure that the leads are marked in accordance with the markings on the hydraulic modulator, and are re-connected correctly (for example, VL from hydraulic modulator must be connected to the left front wheel-brake cylinder).

* Designation on hydraulic modulator:

VL =Connection for left front brake line (wheel brake cylinder)
VR =Connection for right front brake line (wheel brake cylinder)
HR =Connection for right rear brake line (wheel brake cylinder)
HL =Connection for left rear brake line (wheel brake cylinder)



- 1 = Hydraulic modulator
- 2 = Brake lines to brake master cylinder
- 3 = Screw for cover
- 4, 5, 6, 7 = Brake line to fixed brake calipers HL, HR, VL, VR
- 8 = Cover
- 9 = Motor relay
- 10 = Valve relay
- 11 = Ground lead for pump motor
- 12 = Holder



Continued on next microimage

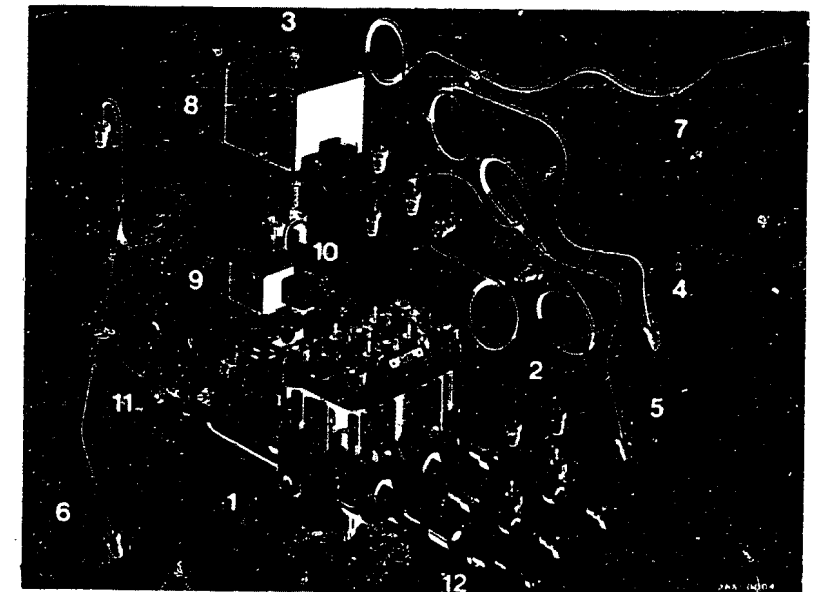
TEST STEP 7 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

- * Only the specified 9 x 11 mm double-headed box wrench may be used to loosen and tighten the brake lines.
- * Mark the brake lines and disconnect them from the hydraulic modulator.
- * Catch brake fluid. It must not be allowed to get onto skin, clothing, or paint!
- * Immediately plug the brake lines and connections with dummy plugs.
- * Disconnect ground lead (11) at pump motor.
- * Loosen fastening screw and remove the cover.
- * Loosen the clip and remove the plug.
- * Loosen hex nuts from holder (12) and take out the hydraulic modulator.

Installation

- * Insert hydraulic modulator into holder and fasten with hex nuts.
- * Connect ground lead to pump motor.
Insert 13-pin plug and fasten with clip.
- * Affix the cover (8) to the hydraulic modulator with the screw (3).
- * Connect brake lines to the hydraulic modulator corresponding to markings.
- * Observe correct tightening torque for brake-line connections at hydraulic modulator: 12...16 Nm.
- * Bleed brake system and check for sealing.
- * Carry out complete test of ABS using tester.

Continued on next microimage



- 1 = Hydraulic modulator
- 2 = Brake lines to master cylinder
- 3 = Screw for cover
- 4 = Brake line to left rear fixed brake caliper
- 5 = Brake line to right rear fixed brake caliper
- 6 = Brake line to left front fixed brake caliper
- 7 = Brake line to right front fixed brake caliper
- 8 = Cover
- 9 = Motor relay
- 10 = Valve relay
- 11 = Ground lead for pump motor
- 12 = Holder

TEST STEP 8

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Ground connection terminal term.10
Contact resistance.

N>

Operation:

Program-switch position: ☒ 7

Illuminated button lights up,
press button.

Operation in vehicle:

Switch off ignition.

Test specification (reading):

80...300 mV

Is the measured value within the
tolerance range ?

Trouble-shooting

(Switch off ignition):

1. Reading less than 80 mV:
Have tester inspected.
2. Reading greater than 300 mV:
Test ground terminal (below
switchboard) and plug connec-
tions term.31 and, where
present, term.31b on over-
voltage-protec-tion relay or
combination relay for excessive
contact resistance.
Test lead for open circuit:
From ground to multiple plug
K1/term.10 and over-voltage-
protection relay term.31.



In Audi 200 (until 8.83):

1 = Controller

2 = Over-volt.-protect. relay

Audi 100 (until 8.83):

7 = Over-voltage-protection
relay

8 = Relay for controller

Installation position of components:

Installation position in Audi 100 and
200 (from 9.83):

Relay location 7 =

Relay for controller

Relay location 11 =

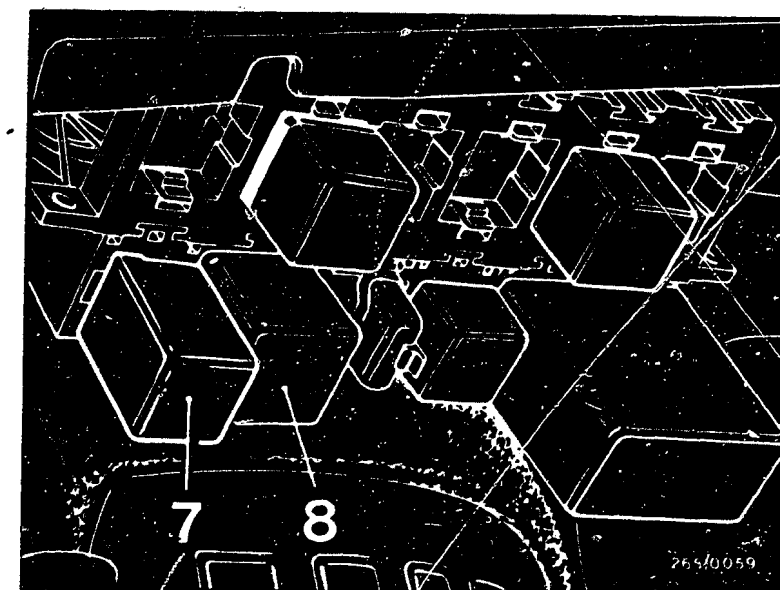
Over-voltage-protection relay

Installation position from 8.84

in all Audi models

Relay location 5 =

Combination relay



Continued on next coordinate

TEST STEP 9 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:
Ground connection term.34.
Contact resistance.

N>

Operation:
Program-switch position: 8

Illuminated button lights up,
press button.

Operation in vehicle:
Switch on ignition.

Test specification (reading):
30...250 mV

Is the measured value within
the test-specification
tolerance range ?

Trouble-shooting:
(Switch off ignition)

1. Reading below 30 mV:

Have tester inspected.

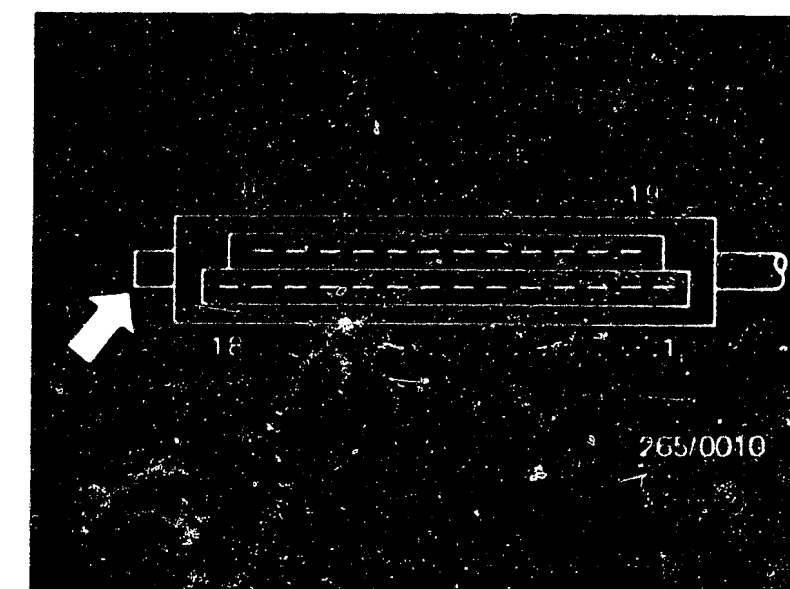
2. Reading above 250 mV:

Test ground terminal for
excessive contact resistance
and open circuit.
Test lead for open circuit:
From ground to multiple plug
K1/term.34.



5 = ABS ground terminal

Top view of multiple plug
K1 (35-pin) with terminal
numbers.
Arrow = Lug with mechanical
encoding



Continued on next coordinate

TEST STEP 10

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Ground connection term.20.
Contact resistance.

N>

Operation:

Program-switch position: ☐ 9

Illuminated button lights up,
press button.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

30...250 mV

Is the measured value within the
test-specification tolerance
range ?

Trouble-shooting:

(Switch off ignition)

1. Reading below 30 mV:

Have tester inspected.

2. Reading above 250 mV:

Test ground terminal for
excessive contact resistance
and open circuit.

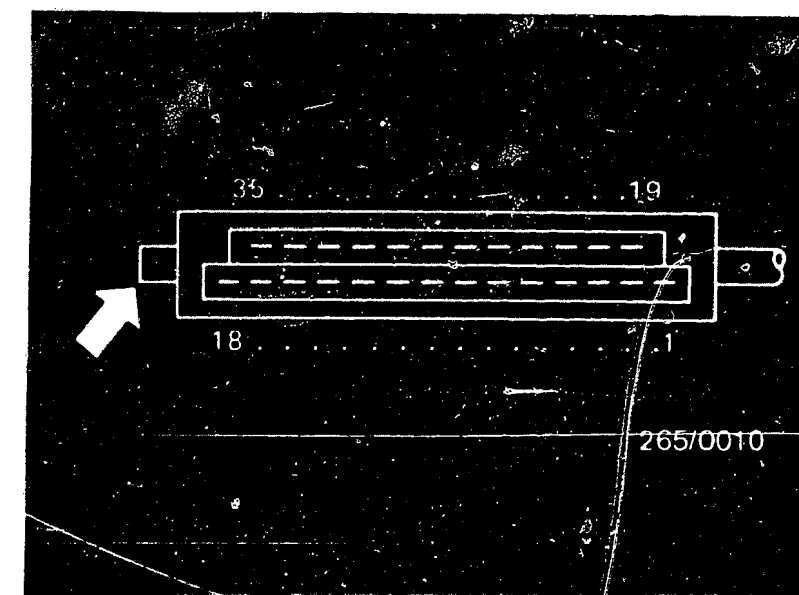
Test lead for open circuit:
From ground to multiple plug
K1/term.20.



5 = ABS ground terminal

Top view of multiple plug
K1 (35-pin) with terminal
numbers.

Arrow = Lug with mechanical
encoding



Continued on next coordinate

D03

<=>

D04

<=>

TEST STEP 11

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Components/Function:

Internal resistance of left and right front wheel-speed sensors.

N>

Operation:

Program-switch position: 10

Press the VL and VR buttons one after the other.
Note the reading after each button is pressed.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

0,8...1,8 k Ω

1)

Is the measured value within the test-specification tolerance range ?

1) = Note:

If a vehicle is brought in with the following complaint:

"Warning lamp lights up occasionally, after restarting or operating the off switch the warning lamp stays off",

the cause can be a loose contact in the wheel-speed sensor leads or the 2-pin wheel-speed sensor plug connections.

These are occasional interruptions or lead contacts caused by vibrations or changes in loading.

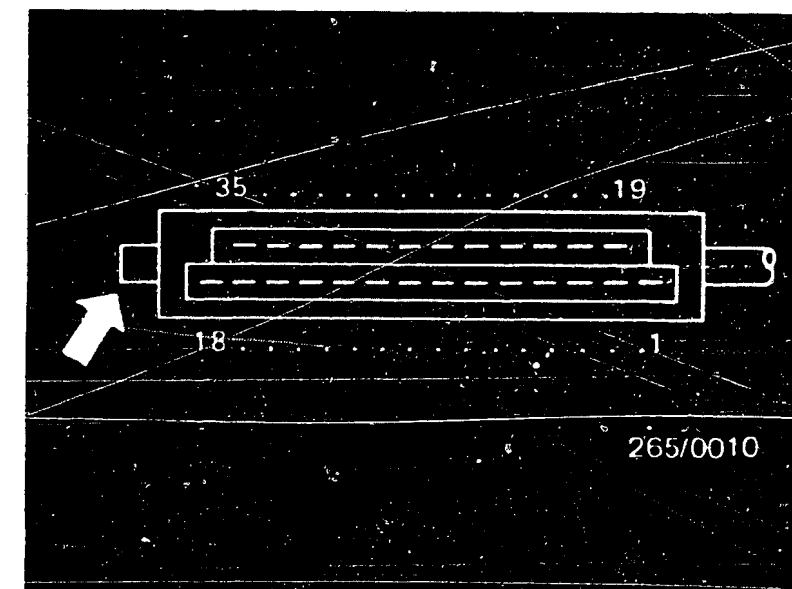
Ascertain the fault by the following method.



Arrow = Wheel-speed sensor plug connection in engine compartment

Top view of multiple plug K1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical encoding



Continued D15

Continued on next coordinate

D05

<=>

D06

<=>

Note:

Loose-contact test method for wheel-speed sensors:

- * Select all 4 wheel-speed sensors one after the other by pushbutton.
- * For each wheel-speed sensor, move, bend, and pull the appropriate cable directly at the wheel-speed sensor as well as at the fastening clamps, and particularly at the rubber buffers and the 2-pin plug connection.
- * Simultaneously, observe the digital display of the tester:
If the digital display shows a sharp change, there is a loose contact.
If the lead is interrupted, the reading will increase (max. 999), if there is a short circuit (usually at the wiring-harness-side plug) the reading will become smaller (min.000).
- * Replace the wheel-speed sensor.

Testing wheel-speed sensor plug connections:

- * If the wheel-speed sensor leads are OK, the 2-pin plug connections of the wheel-speed sensors on the wiring-harness-side must be checked for loose contacts in the same manner.
- * If a loose contact appears at a 2-pin plug connection (wiring-harness-side), repair using the repair set.

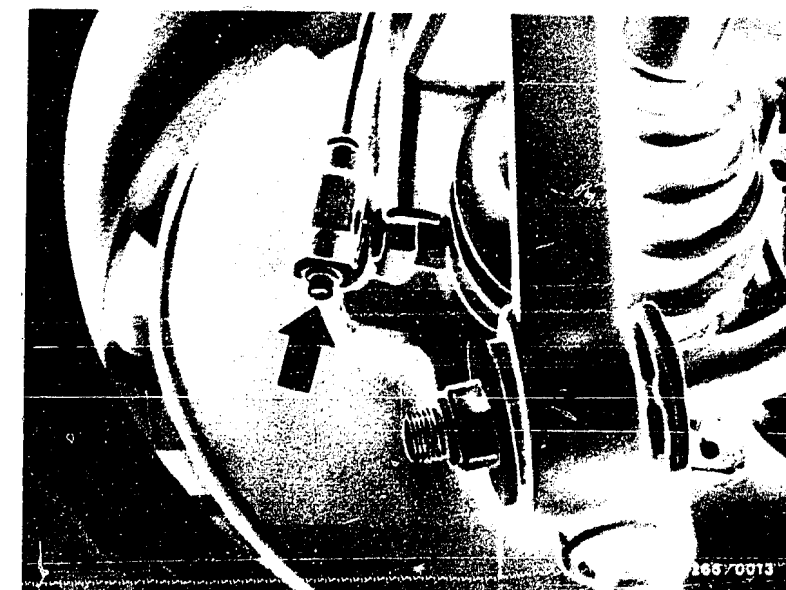
Repairing plug connections:

- * Disconnect battery.
- * Separate the wheel-speed sensor plug connections for the front wheels in the engine compartment 25 mm behind the wiring-harness-side plug.
Disconnect the wheel-speed sensor plug connections for the rear wheels below the rear seat 150 mm behind the wiring-harness-side plug.



Arrow = Wheel-speed sensor
plug connection in
engine compartment

Arrow : Fastening screw for
wheel-speed sensor



Continued on next microimage

TEST STEP 11 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

Note:

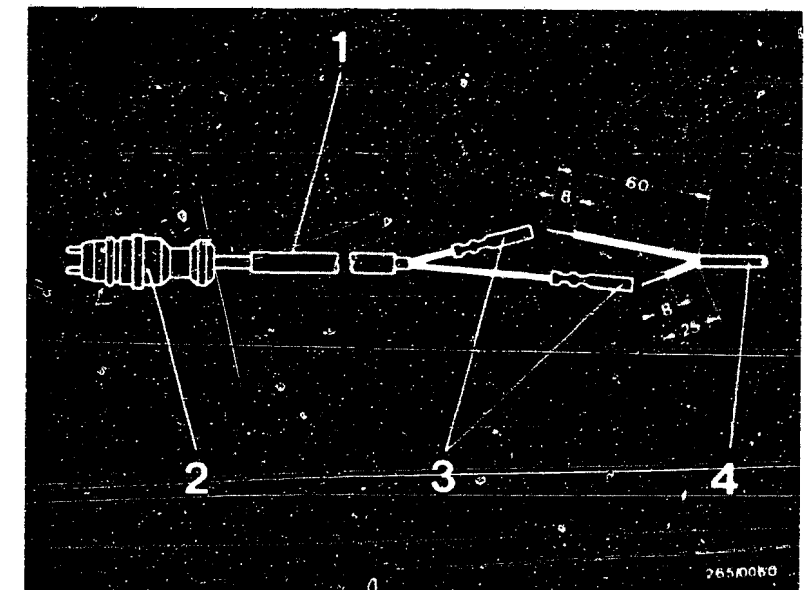
- * Carefully remove the black outer insulation to a length of 60 mm. The insulation of the two inner strands must under no circumstances be damaged.
- * Shorten a cable to 25 mm and remove the insulation on both ends to expose about 8 mm of bare metal (drawing).
- * Carefully crimp on new wheel-speed sensor plug connections using Eisemann-type crimping pliers in order to prevent a recurrence of the trouble.
- * Push a heat-shrinkable sleeve over the crimped connection and heat with a hot-air blower. Heating temperature must be at least 125°C, since the heat-shrinkable sleeve is coated on the inside with a heat-setting adhesive.

Carry out this work carefully in order to guarantee that the repair point is sealed against humidity.

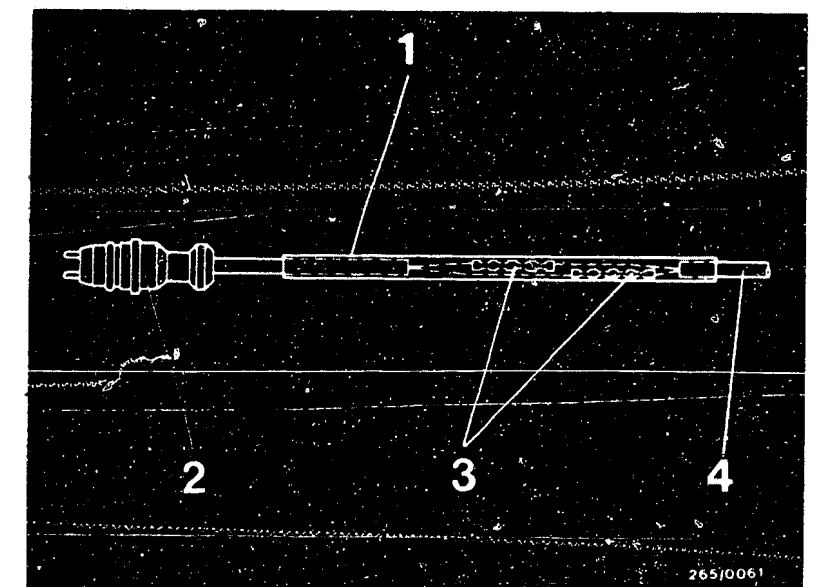
In order to avoid having to replace the complete wiring harness, Audi offers the repair set 431 971 415 A for the repair of the plug connection (wiring-harness side).
(The corresponding repair set from BMW can also be used)

The repair set consists of a plug, pre-assembled plug connections and insulating heat-shrinkable sleeve.

If necessary, repair sets can be obtained from VAG or BMW workshops.



- 1 = Heat-shrinkable lead
- 2 = Repair plug
- 3 = Crimp terminals
- 4 = ABS wiring harness



Continued on next microimage

Trouble-shooting (switch off ignition)

1. Measure internal resistance at disconnected couplings.
If nominal value is not reached, replace the appropriate wheel-speed sensor.
2. Test following leads for continuity:
From plug K11 to multiple plug K1/term.5 and term.4.
From plug K13 to multiple plug K1/term.23 and term.21.
3. Inspect plug connections.

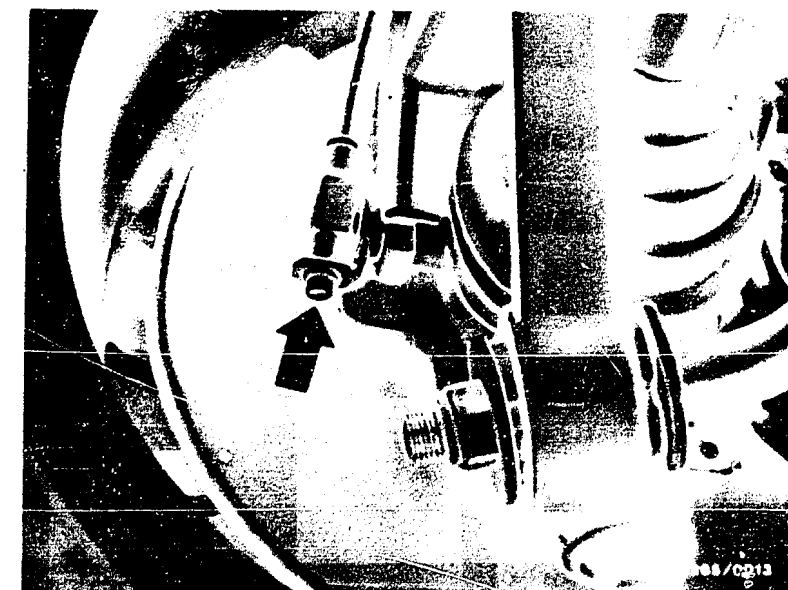
Removing wheel-speed sensor at front axle

- * Disconnect wheel-speed-sensor plug connection in engine compartment.
- * Installation positions of plug connections:
In engine compartment on left and right on wheel wells.
- * Remove plug connection from holder and disconnect.
- * Unscrew cable holders on wheel-bearing housing and wheel well.
- * Unscrew fastening screw for wheel-speed sensor and remove wheel-speed sensor.
Do not use force!



Arrow = Wheel-speed sensor
plug connection in
engine compartment

Arrow : Fastening screw for
wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the front axle

- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike! The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw. Tighten the fastening screw to 6...8 Nm. During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reattach at the places provided.

Note:

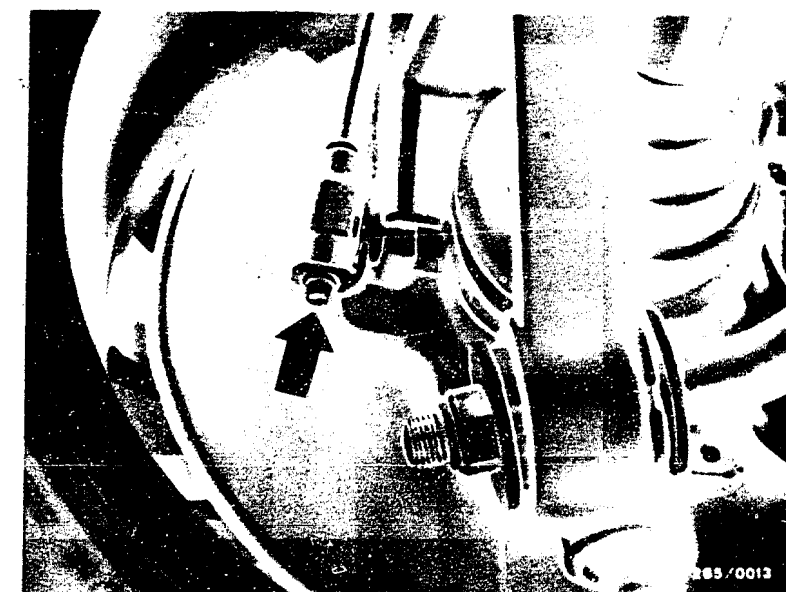
The fastening point for the wheel-speed sensor cable on the wheel-bearing housing is marked with a white and red stripe.

- * Connect the wheel-speed sensor with the ABS wiring harness.

I M P O R T A N T !

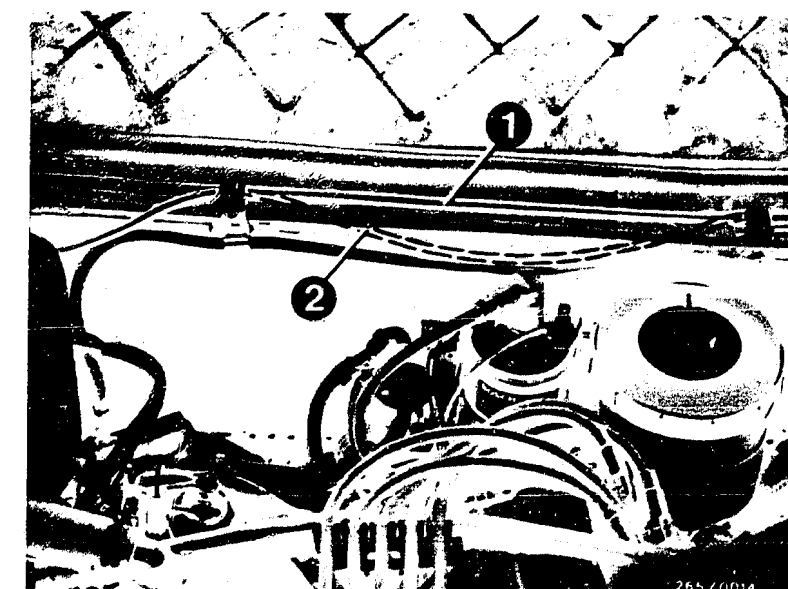
- * Observe lead routing over the ignition coil! The lead must not hang down! If necessary, provide additional fastening.
- * After repair, carry out testing using the ABS tester.

Continued on next microimage



Arrow : Fastening screw for wheel-speed sensor

- 1 = Correct lead routing
- 2 = Incorrect lead routing



TEST STEP 12

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Internal resistance of wheel-speed sensors, left and right rear.

N>

Operation:

Program-switch position: 10

Press the HL and HR buttons one after the other.
Note reading after pressing each button.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

0,8...1,8 k Ω 1)

Is the measured value within the test-specification tolerance range in each case ?

1) = Note:

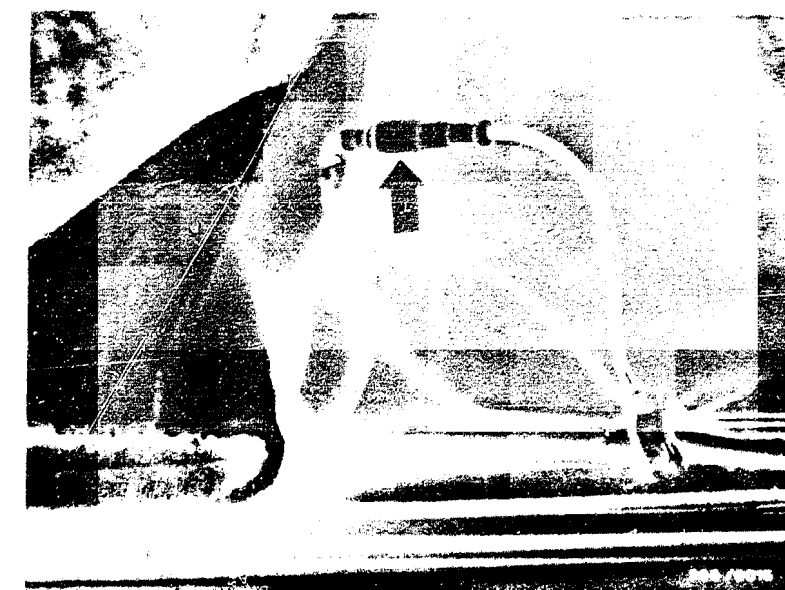
If a vehicle is brought in with the following complaint:

"Warning lamp lights up occasionally, after restarting or operating the off switch the warning lamp stays off",

the cause can be a loose contact in the wheel-speed sensor leads or the 2-pin wheel-speed sensor plug connections.

These are occasional interruptions or lead contacts caused by vibrations or changes in loading.

Ascertain the fault by the following method.



Arrow = Wheel-speed sensor – plug connection below rear seat in Audi 200

In the Audi 100 und 200 (from 9.83):

- 1 = Wheel-speed sensor – plug connection below rear seat on the right
- 2 = Pump for central locking system



Continued D25

Continued on next coordinate

Note:

Loose-contact test method for wheel-speed sensors:

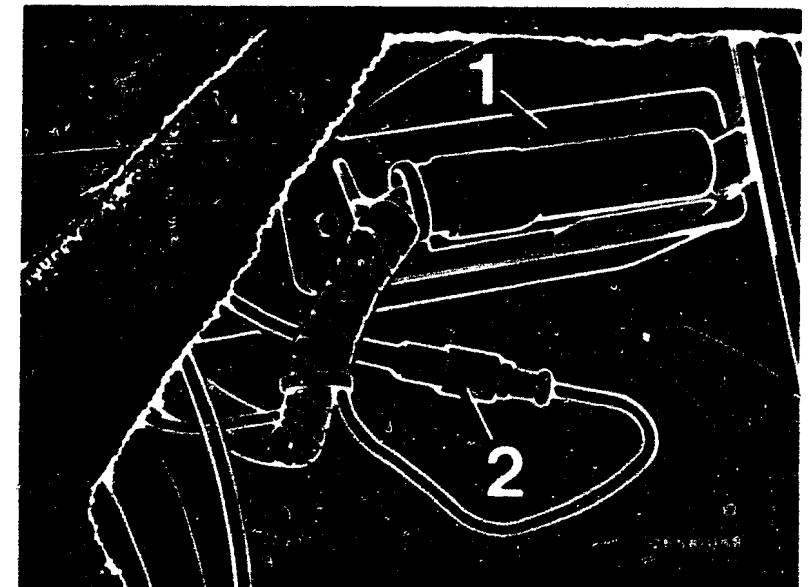
- * Select all 4 wheel-speed sensors one after the other by pushbutton.
- * For each wheel-speed sensor, move, bend, and pull the appropriate cable directly at the wheel-speed sensor as well as at the fastening clamps, and particularly at the rubber buffers and the 2-pin plug connection.
- * Simultaneously, observe the digital display of the tester:
If the digital display shows a sharp change, there is a loose contact.
If the lead is interrupted, the reading will increase (max. 999), if there is a short circuit (usually at the wiring-harness-side plug) the reading will become smaller (min.000).
- * Replace the wheel-speed sensor.

Testing wheel-speed sensor plug connections:

- * If the wheel-speed sensor leads are OK, the 2-pin plug connections of the wheel-speed sensors on the wiring-harness-side must be checked for loose contacts in the same manner.
- * If a loose contact appears at a 2-pin plug connection (wiring-harness-side), repair using the repair set.

Repairing plug connections:

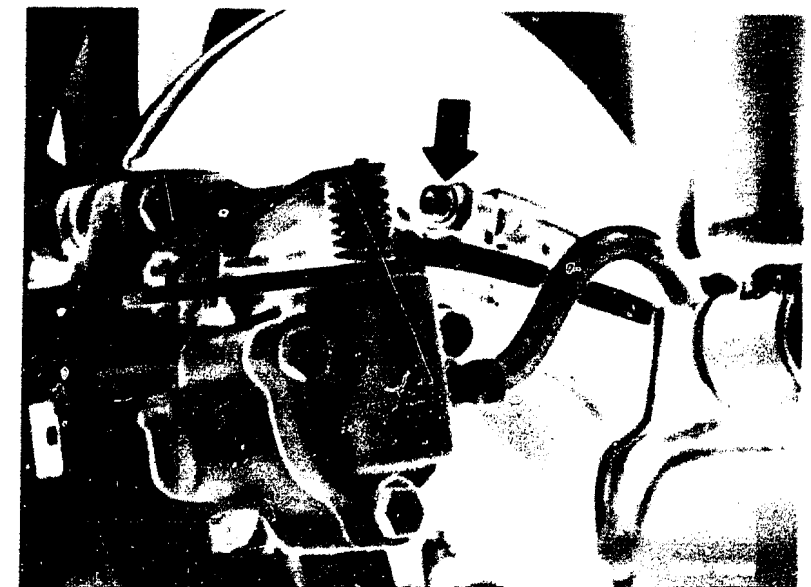
- * Disconnect battery.
- * Separate the wheel-speed sensor plug connections for the front wheels in the engine compartment 25 mm behind the wiring-harness-side plug.
Disconnect the wheel-speed sensor plug connections for the rear wheels below the rear seat 150 mm behind the wiring-harness-side plug.



In the Audi 100 und Audi 200
(from 9.83)

- 1 = Controller below rear seat
- 2 = Wheel-speed sensor plug connection

Arrow = Fastening screw for wheel-speed sensor



Continued on next microimage

Note:

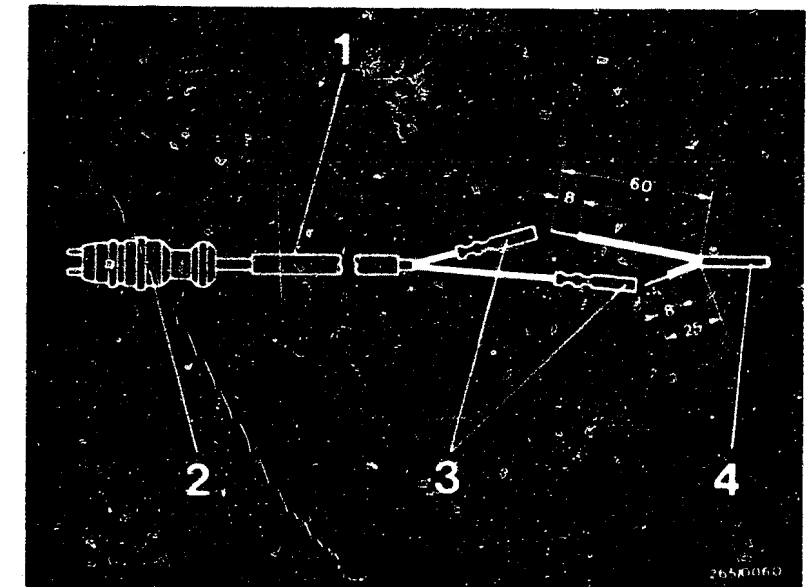
- * Carefully remove the black outer insulation to a length of 60 mm. The insulation of the two inner strands must under no circumstances be damaged.
- * Shorten a cable to 25 mm and remove the insulation on both ends to expose about 8 mm of bare metal (drawing).
- * Carefully crimp on new wheel-speed sensor plug connections using Eisemann-type crimping pliers in order to prevent a recurrence of the trouble.
- * Push a heat-shrinkable sleeve over the crimped connection and heat with a hot-air blower. Heating temperature must be at least 125°C, since the heat-shrinkable sleeve is coated on the inside with a heat-setting adhesive.

Carry out this work carefully in order to guarantee that the repair point is sealed against humidity.

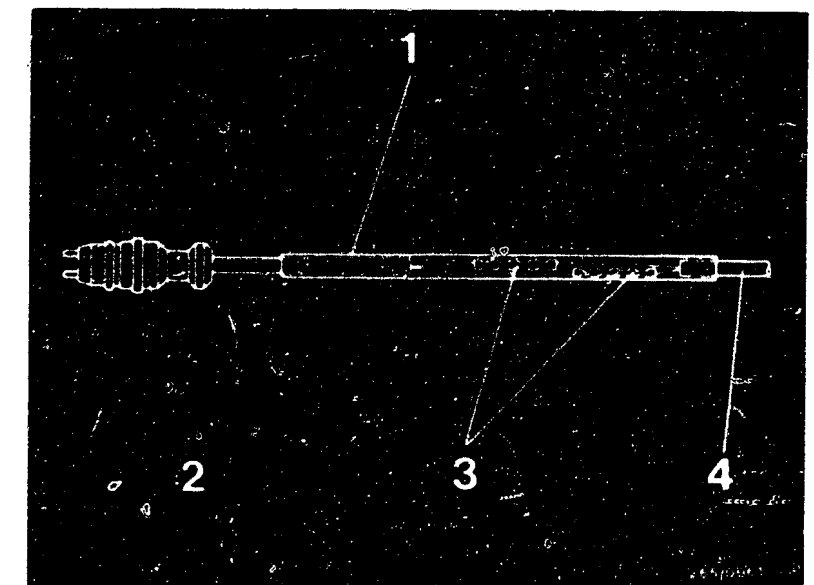
In order to avoid having to replace the complete wiring harness, Audi offers the repair set 431 971 415 A for the repair of the plug connection (wiring-harness side).
(The corresponding repair set from BMW can also be used)

The repair set consists of a plug, pre-assembled plug connections and insulating heat-shrinkable sleeve.

If necessary, repair sets can be obtained from VAG- or BMW-workshops.



- 1 = Heat-shrinkable lead
- 2 = Repair plug
- 3 = Crimp terminals
- 4 = ABS wiring harness



Continued on next microimage

Trouble-shooting (switch off ignition)

1. Measure internal resistance at disconnected couplings.
If nominal value is not reached: replace the wheel-speed sensor involved.
2. Check following leads for continuity:
From plug K15 to multiple plug K1/term.7 and term.9.
From plug K17 to multiple plug K1/term.24 and term.26.
3. Inspect plug connections.

Removing wheel-speed sensors at rear axle

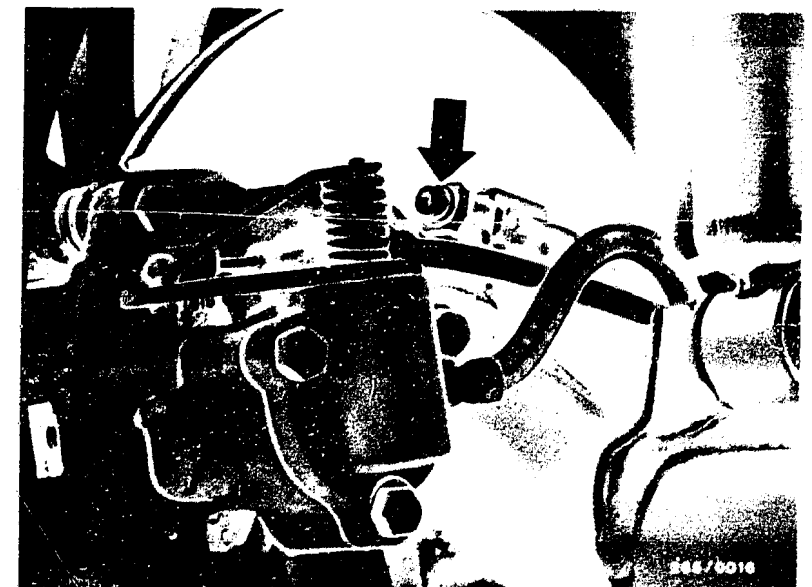
- * Separate wheel-speed-sensor plug connection underneath rear seat.
- * Remove rear seat.
Unscrew cover strip from ridge.
Turn back carpeting and disconnect plug connection.
- * Loosen wheel-speed-sensor fastening screw and pull out wheel-speed sensor. Do not use force.



In the Audi 100 und 200
(from 9.83):

- 1 = Wheel-speed sensor –
plug connection below
rear seat on the right
- 2 = Pump for central locking
system

Arrow = Fastening screw for
wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the rear axles

- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-s
the stop on the ring gear Arrow = Fastening screw for wheel-speed sensor
The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw.
Tighten the fastening screw to 6...8 Nm.
During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reaffix at the places provided.

Note:

The fastening points of the wheel-speed-sensor lead on the trailing arms of the rear axle are marked with a white and red stripe.

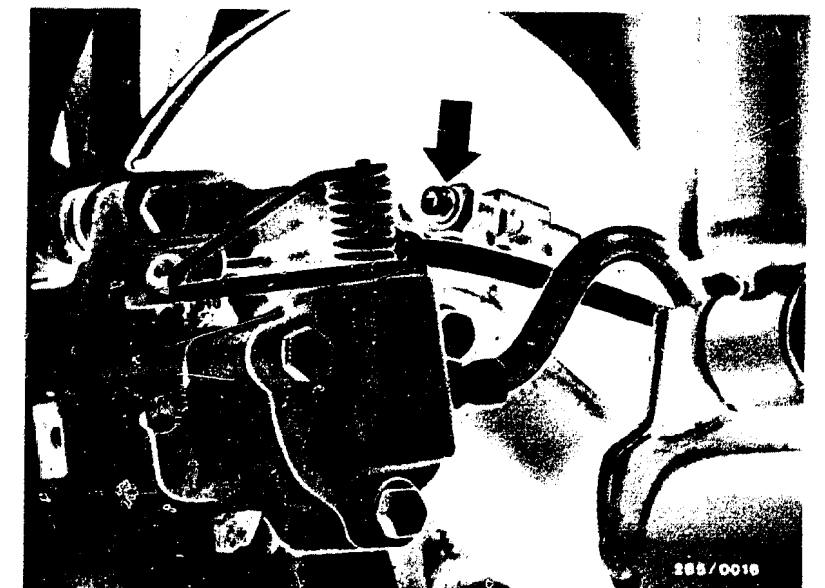
- * Connect wheel-speed sensor to ABS wiring harness.
- * After repair, test with the ABS tester.

Continued on next microimage



In the Audi 100 und Audi 200 (from 9.83)

- 1 = Controller below rear seat
- 2 = Wheel-speed sensor plug connection



TEST STEP 13

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Internal resistance of left and right front wheel-speed sensors.

N>

Operation.

Program-switch position: 11

Press the VL and VR buttons one after the other.
Note the reading after each button is pressed.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

20...999 k Ω 1)

Is the measured value within the test-specification tolerance range each time?

Trouble-shooting

(Switch off ignition)

Are plug connections OK ?

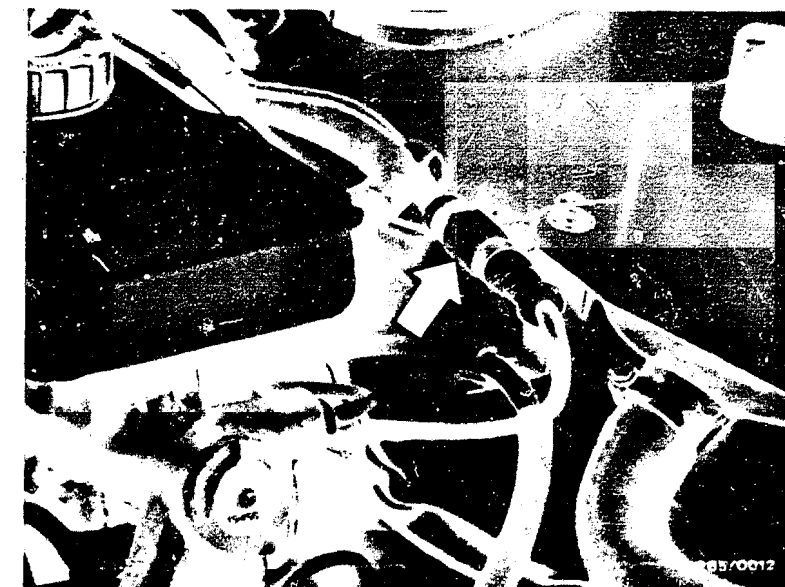
Disconnect plug connections and bridge the plug leading to the tester.

Repeat test:

If the reading is now good, replace the wheel-speed sensor.

If the reading is still below the nominal value, the leads from the multiple plug term.5 and term.4 or term.23 and term. 21 to the appropriate plug are defective.

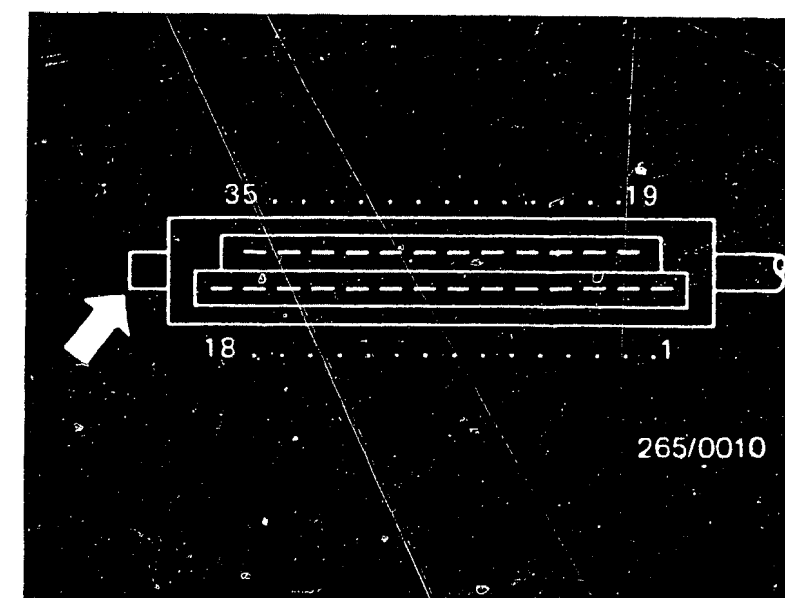
Check all leads for abrasion points and short-circuit to the ground.



Arrow = Wheel-speed sensor plug connection in engine compartment

Top view of multiple plug K1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical encoding



Continued E09

Continued on next coordinate

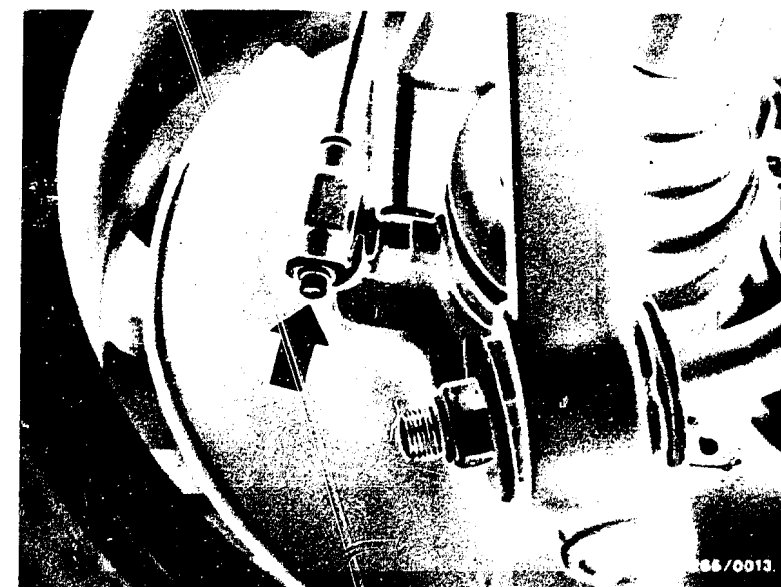
Removing wheel-speed sensors on front axle

- * Disconnect wheel-speed-sensor plug connection in engine compartment.
- * Installation position of plug connections:
In engine compartment left and right on wheel wells.
- * Remove plug connection from holder and disconnect.
- * Unscrew cable holders on wheel-bearing housing and wheel well.
- * Unscrew fastening screw for wheel-speed sensor and pull wheel-speed sensors out
Do not use force!



Arrow = Wheel-speed sensor
plug connection in
engine compartment

Arrow : Fastening screw for
wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the front axle

- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike! The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw. Tighten the fastening screw to 6...8 Nm. During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reattach at the places provided.

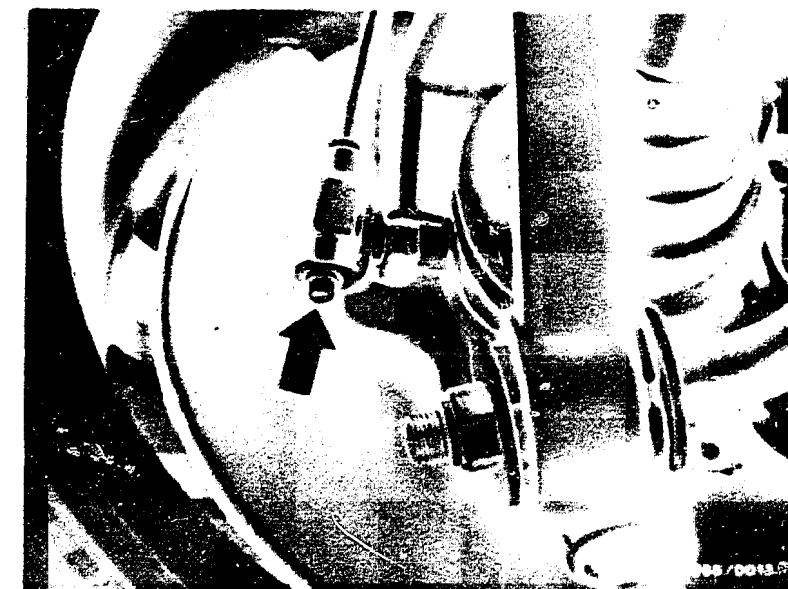
Note:

The fastening point for the wheel-speed sensor cable on the wheel-bearing housing is marked with a white and red stripe.

- * Connect the wheel-speed sensor with the ABS wiring harness.

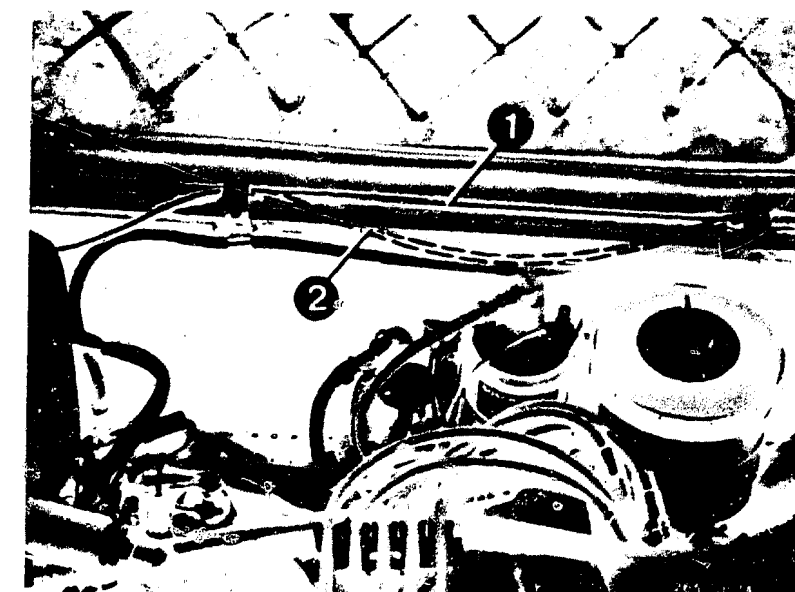
I M P O R T A N T !

- * Observe lead routing over the ignition coil! The lead must not hang down! If necessary, provide additional fastening.
- * After repair, carry out testing using the ABS tester.



Arrow : Fastening screw for wheel-speed sensor

- 1 = Correct lead routing
- 2 = Incorrect lead routing



Continued on next microimage

TEST STEP 14

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Insulation resistance of left and right rear wheel-speed sensors.

N>

Operation:

Program-switch position: **11**

Note the reading after each button is pressed.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

20...999 k Ω 1)

Is the measured value within the test-specification tolerance range in each case ?

Trouble-shooting

(Switch off ignition)

Are plug connections OK ?

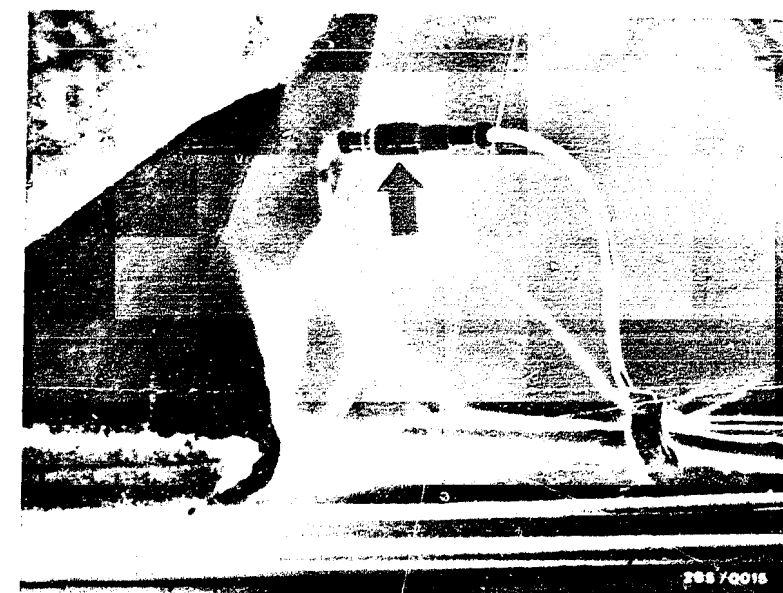
Disconnect plug connections and bridge the plug leading to the tester.

Repeat test:

If the reading is now good, replace the wheel-speed sensor.

If the reading is still below the nominal value, the leads from the multiple plug term.7 and term.9 or term.24 and term. 26 to the appropriate plug are defective.

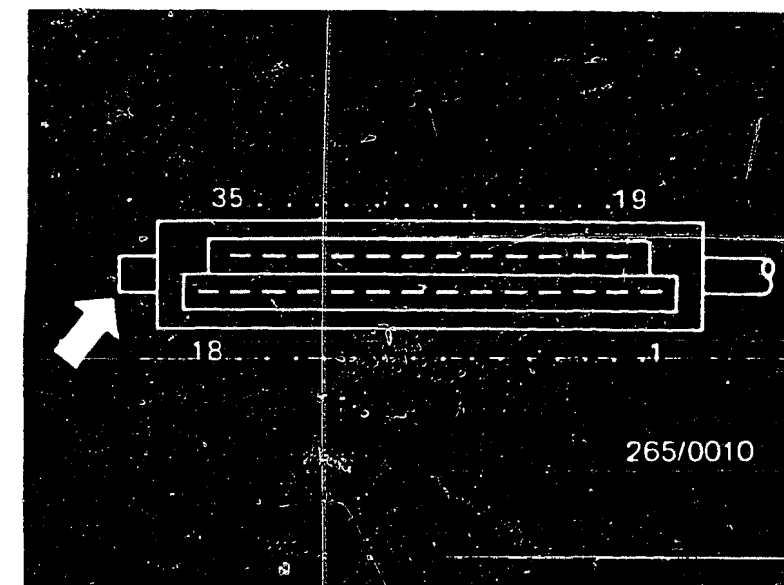
Check all leads for abrasion points and short-circuit to the ground.



Arrow = Wheel-speed sensor - plug connection below rear seat in Audi 200

Top view of multiple plug K1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical encoding



Continued on next coordinate

Continued on next coordinate

E03

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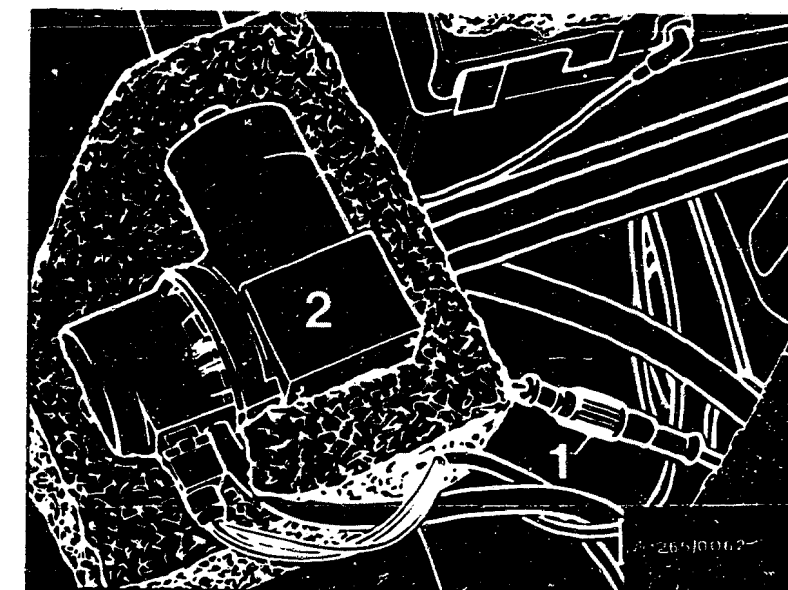
E04

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TEST STEP 14 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

Removing rear-axle wheel-speed sensors

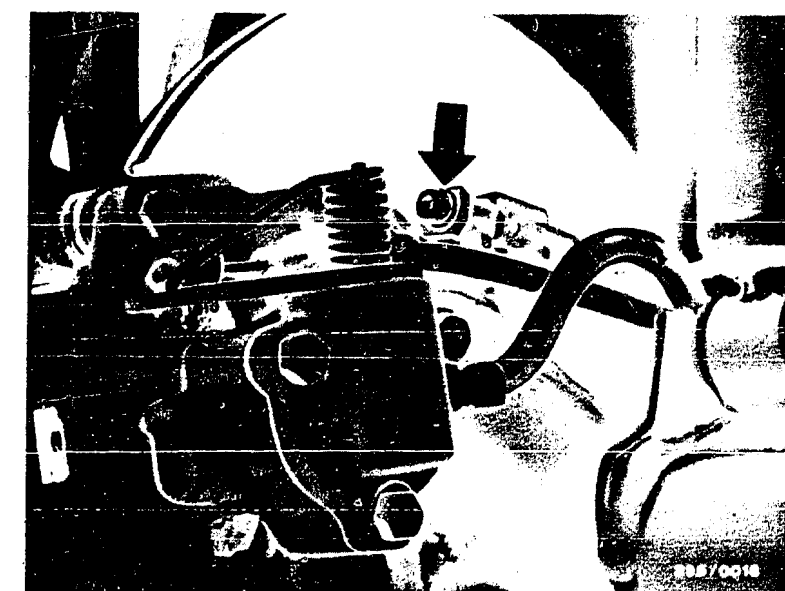
- * Separate wheel-speed sensor plug connection under rear seat.
- * Remove rear seat.
Unscrew cover strip from ridge.
Turn back carpeting and disconnect plug connection.
- * Unscrew wheel-speed sensor fastening screw and pull out wheel-speed sensor.
Do not use force!



In the Audi 100 and 200
(from 9.83):

- 1 = Wheel-speed sensor –
plug connection below
rear seat on the right
- 2 = Pump for central locking
system

Arrow = Fastening screw for
wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the rear axles

- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike! The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw. Tighten the fastening screw to 6...8 Nm. During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reattach at the places provided.

Note:

The fastening points of the wheel-speed-sensor lead on the trailing arms of the rear axle are marked with a white and red stripe.

- * Connect wheel-speed sensor to ABS wiring harness.
- * After repair, test with the ABS tester.

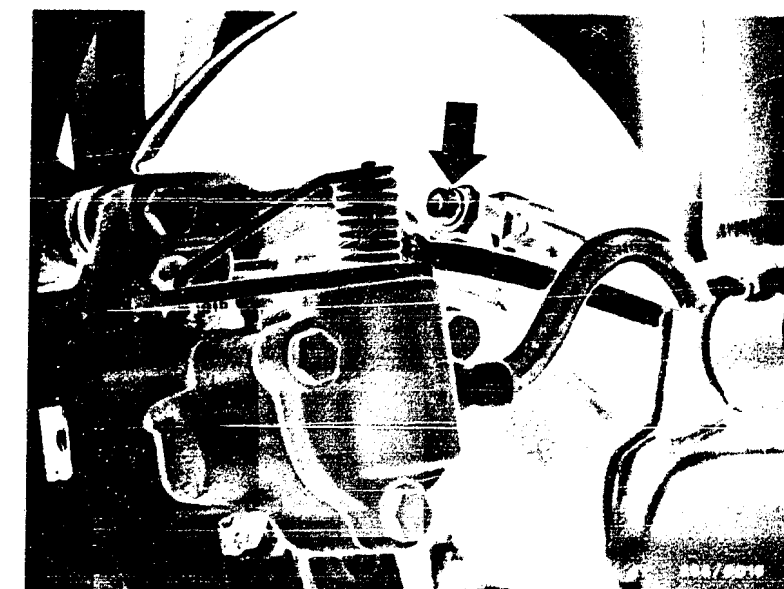
Continued on next microimage



In the Audi 100 und Audi 200 (from 9.83)

- 1 = Controller below rear seat
- 2 = Wheel-speed sensor plug connection

Arrow = Fastening screw for wheel-speed sensor



TEST STEP 15

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:
DC voltage of left and right
front wheel-speed sensor leads.

N>

Operation:

Program-switch position: **12**

Press the VL and VR buttons
one after the other.
Note reading after pressing
each button.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

000...100 mV

Is the measured value within the
test-specification tolerance
range each time ?

Trouble-shooting

(Switch off ignition)

Are plug connections OK ?

Disconnect plug connections and
bridge the plug leading to the
tester.

Repeat test:

If the reading is now good, replace
the wheel-speed sensor.

If the reading is still below the
nominal value, the leads from the
multiple plug term.5 and term.4 or
term.23 and term. 21 to the appro-
priate plug are defective.

Check all leads for abrasion points
and short-circuit to the ground.

Continued E15

Continued on next coordinate

E09

<=>

E10

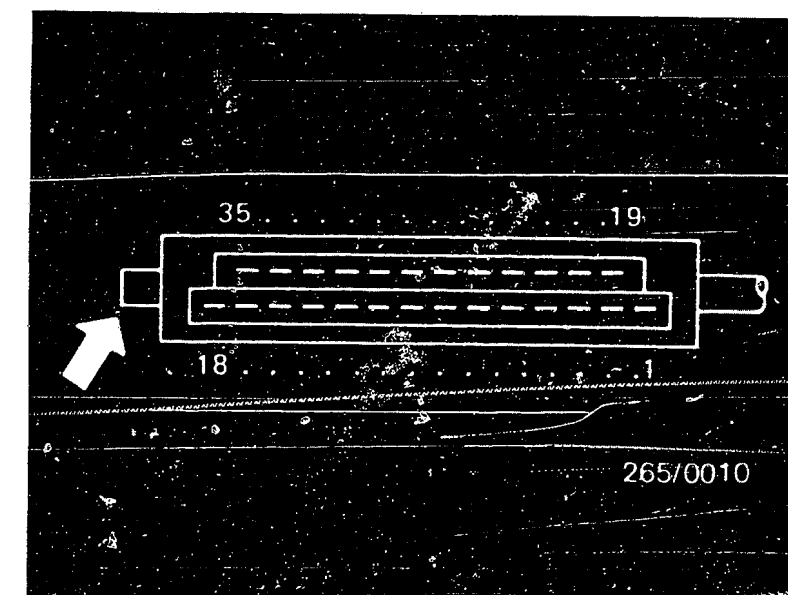
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Arrow = Wheel-speed sensor
plug connection in
engine compartment

Top view of multiple plug
K1 (35-pin) with terminal
numbers.

Arrow = Lug with mechanical
encoding



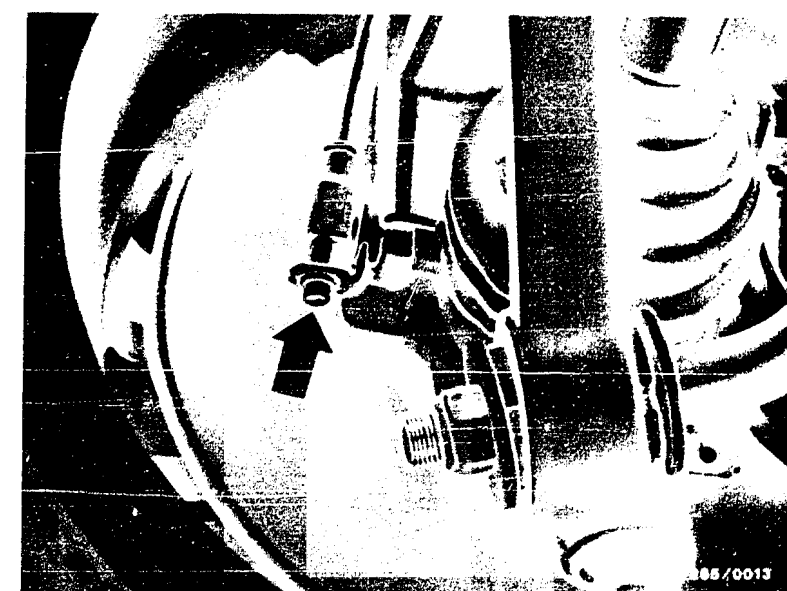
Removing wheel-speed sensors on front axle

- * Disconnect wheel-speed-sensor plug connection in engine compartment.
- * Installation position of plug connections:
In engine compartment left and right on wheel wells.
- * Remove plug connection from holder and disconnect.
- * Unscrew cable holders on wheel-bearing housing and wheel well.
- * Unscrew fastening screw for wheel-speed sensor and pull wheel-speed sensors out
Do not use force!



Arrow = Wheel-speed sensor
plug connection in
engine compartment

Arrow : Fastening screw for
wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the front axle

- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike! The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw. Tighten the fastening screw to 6...8 Nm. During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reaffix at the places provided.

Note:

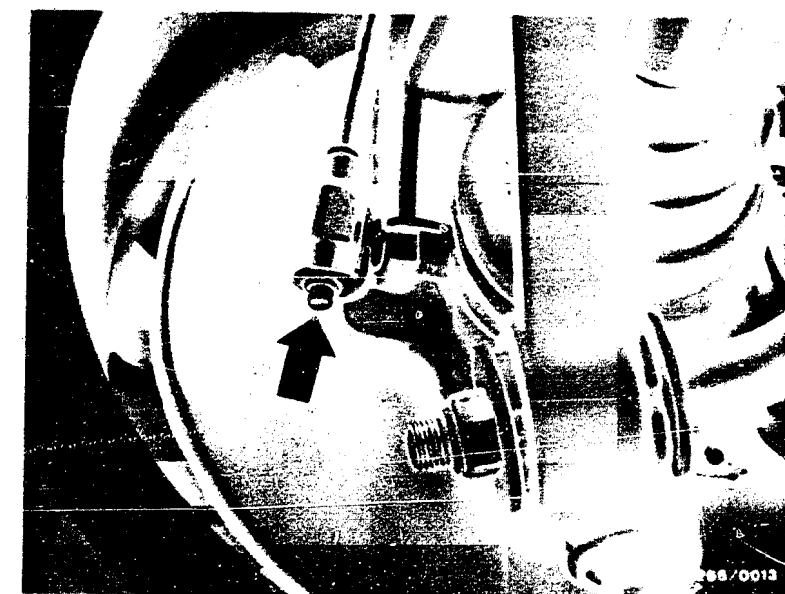
The fastening point for the wheel-speed sensor cable on the wheel-bearing housing is marked with a white and red stripe.

- * Connect the wheel-speed sensor with the ABS wiring harness.

I M P O R T A N T !

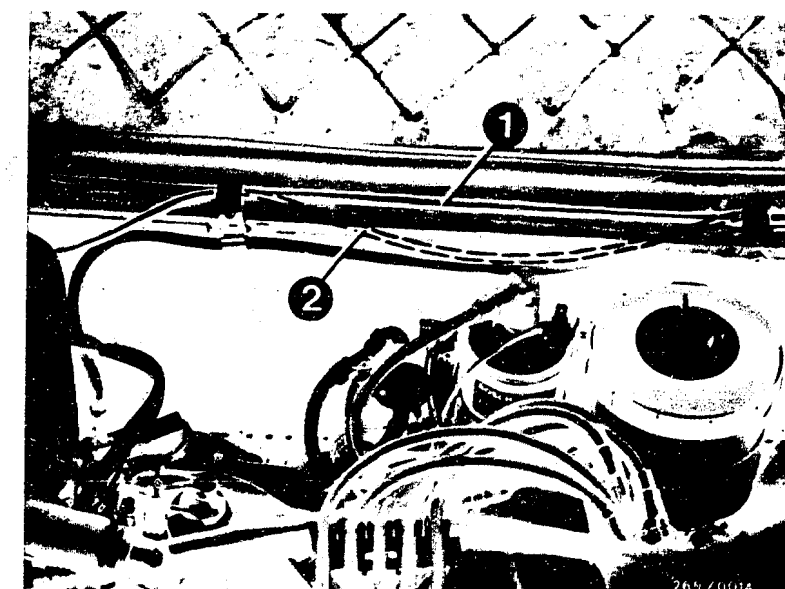
- * Observe lead routing over the ignition coil! The lead must not hang down! If necessary, provide additional fastening.
- * After repair, carry out testing using the ABS tester.

Continued on next microimage



Arrow : Fastening screw for wheel-speed sensor

- 1 = Correct lead routing
- 2 = Incorrect lead routing



TEST STEP 16

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

DC voltage of left and right rear wheel-speed sensor leads.

N>

Operation:

Program-switch position: **12**

Press the HL and HR buttons one after the other.
Note reading after each button is pressed.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

000...100 mV

Is the measured value within the test-specification tolerance range each time ?

Trouble-shooting

(Switch off ignition)

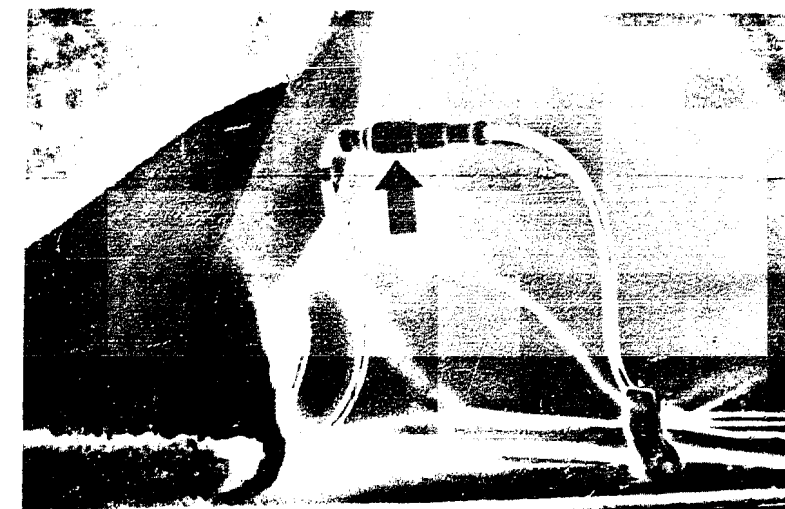
Are plug connections OK ?

Disconnect plug connections and bridge the plug leading to the tester.

Repeat test:

If the reading is now good, replace the wheel-speed sensor.
If the reading is still below the nominal value, the leads from the multiple plug term.7 and term.9 or term.24 and term. 26 to the appropriate plug are defective.

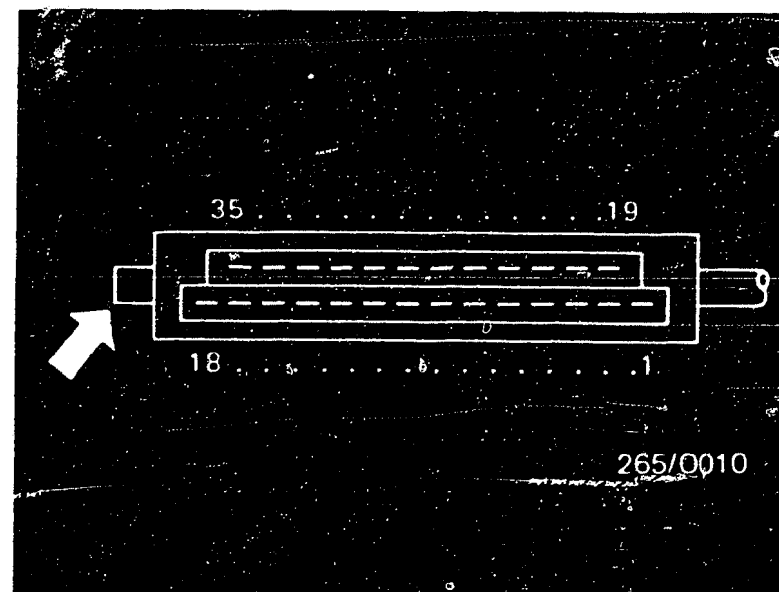
Check all leads for abrasion points and short-circuit to the ground.



Arrow = Wheel-speed sensor - plug connection below rear seat in Audi 200

Top view of multiple plug K1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical encoding



Continued E21

Continued on next coordinate

E15

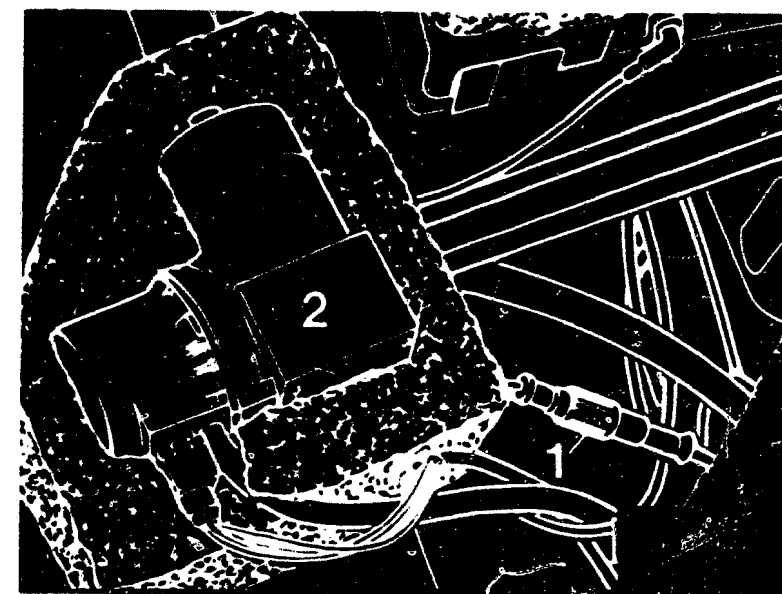


E16



Removing rear-axle wheel-speed sensors

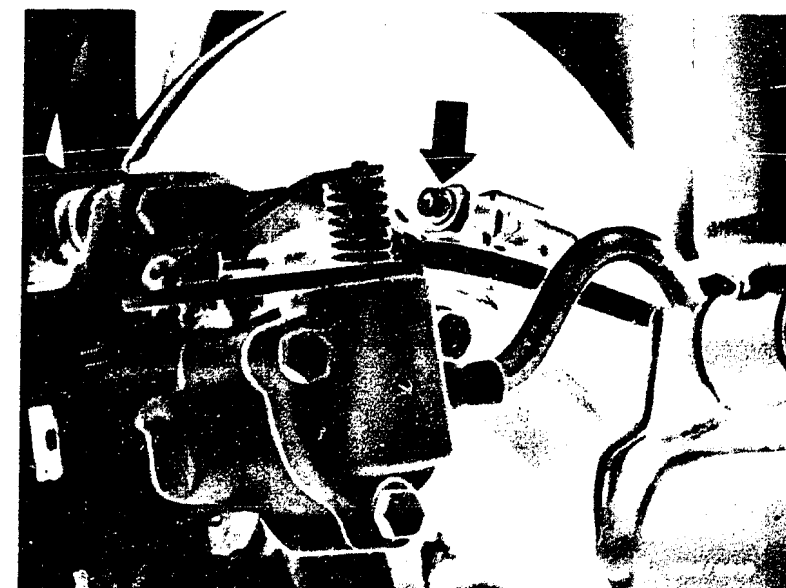
- * Separate wheel-speed sensor plug connection under rear seat.
- * Remove rear seat.
Unscrew cover strip from ridge.
Turn back carpeting and disconnect plug connection.
- * Unscrew wheel-speed sensor fastening screw and pull out wheel-speed sensor.
Do not use force!



In the Audi 100 und 200
(from 9.83):

- 1 = Wheel-speed sensor –
plug connection below
rear seat on the right
- 2 = Pump for central locking
system

Arrow = Fastening screw for
wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the rear axles

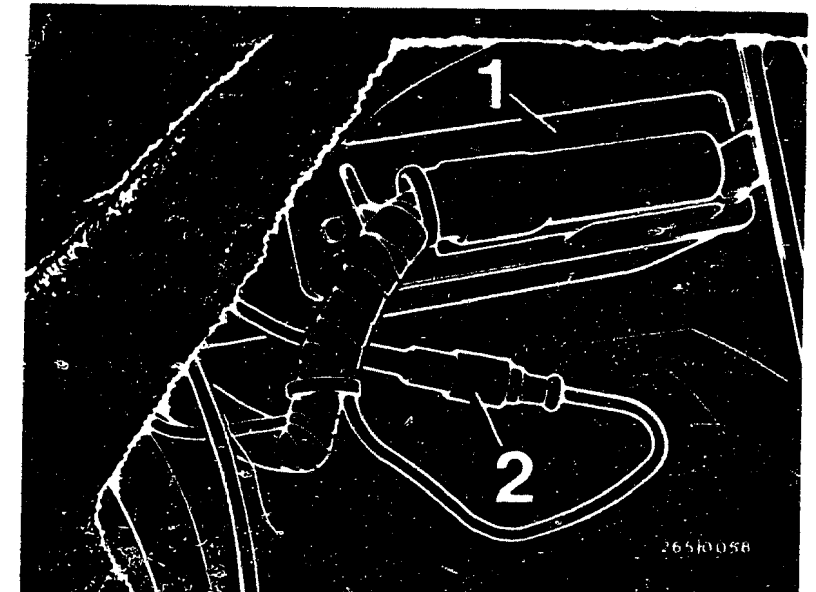
- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike! The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw. Tighten the fastening screw to 6...8 Nm. During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reattach at the places provided.

Note:

The fastening points of the wheel-speed-sensor lead on the trailing arms of the rear axle are marked with a white and red stripe.

- * Connect wheel-speed sensor to ABS wiring harness.
- * After repair, test with the ABS tester.

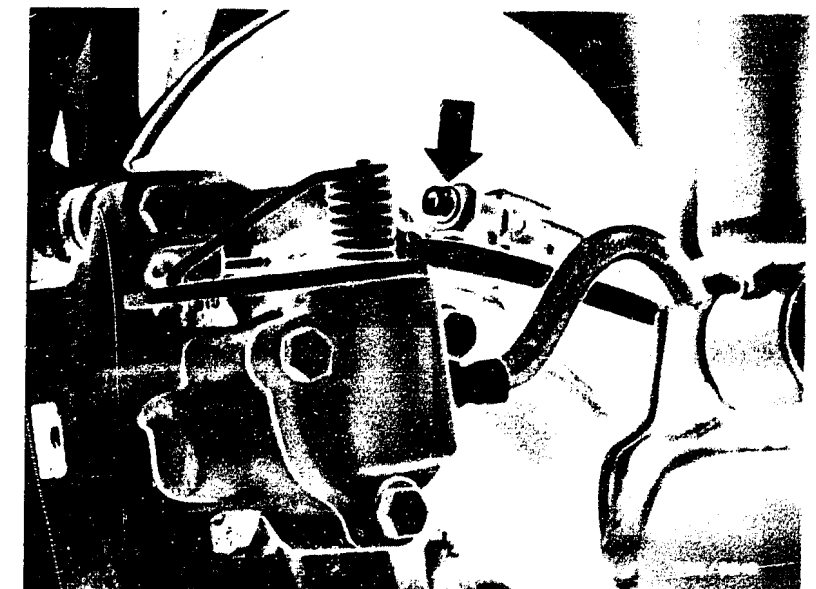
Continued on next microimage



In the Audi 100 und Audi 200 (from 9.83)

- 1 = Controller below rear seat
- 2 = Wheel-speed sensor plug connection

Arrow = Fastening screw for wheel-speed sensor



TEST STEP 17

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:
Controller.
Internal voltage supply.

N>

Operation:
Program-switch position: 13
Illuminated button lights up,
press button.

Operation in vehicle:
Switch on ignition.

Test specification (reading):

Until 08.83:
8,85...9,15 V
(Some controllers have blue
stickers).

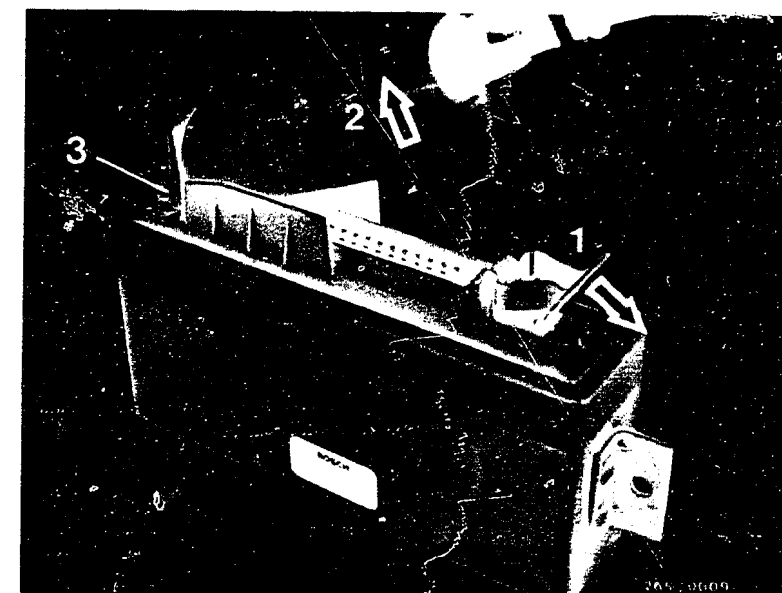
From 09.83:
4,75...5,25 V
(ABS generation 2B.
Some controllers have green
stickers).

Is the measured value within the
test-specification tolerance
range each time ?

Trouble-shooting:
Replace controller (after switching
off ignition).

Note:

- * Switch off the ignition before
disconnecting the multiple plug.
- * To pull out the multiple plug,
push back the spring, hinge
multiple plug up, and disengage
from encoding unit.
- * Install only the specified con-
troller!
- * When installing, make sure that
the multiple plug engages in the
spring.



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding unit

Continued on next coordinate

TEST STEP 18

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Hydraulic modulator and warning lamp.
Diode in conducting direction.

N>

Operation:

Program-switch position: 14

Operation in vehicle:

Switch on ignition.

Test specification (reading):

- * 0,4...1,5 V
- * ABS warning lamp in vehicle must light up.

Is the measured value within the test-specification tolerance range ?

Does the warning lamp light up ?

Continued F01

Trouble-shooting:

(Switch off ignition)

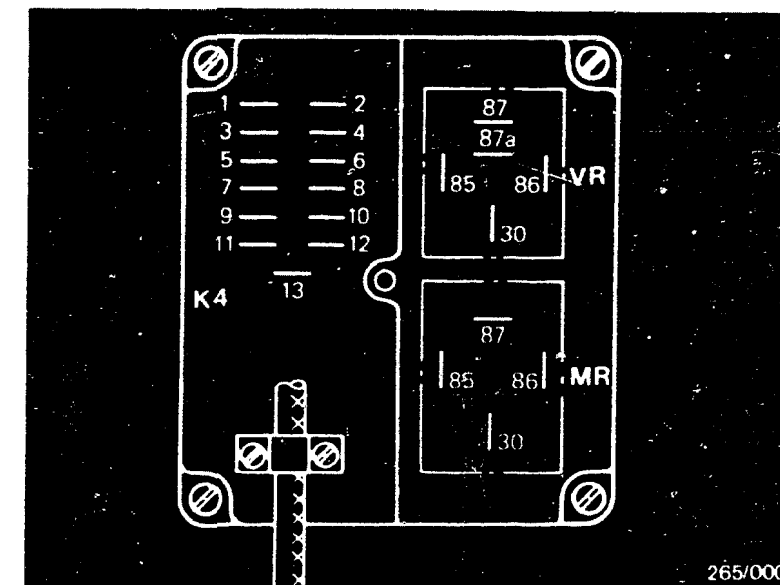
Warning lamp does not light up:

1. Warning lamp defective.
2. Lead to ignition lock has open circuit.
3. Check leads from multiple plug K1/term.29 to hydraulic modulator K3/term.10 for open circuit.
4. Check diode in conducting and non-conducting directions with ohmmeter between K4/term.10 and K4/term.12.

Reading outside tolerance:

1. Check diode in conducting and non-conducting directions with ohmmeter between K4/term.10 and K4/term.12.
2. Check lead between multiple plug K1/K1.29 and ABS warning lamp for open circuit.
3. Check plug connection on warning lamp K3/term.10, K4/term.10, K3/term.8, K4/term.8, and ground lead and valve-relay plug connections for voltage drop. If diode is defective, replace hydraulic modulator.

Continued on next coordinate



Top view of plug-in printed-board assembly for hydraulic modulator. Position of terminals:

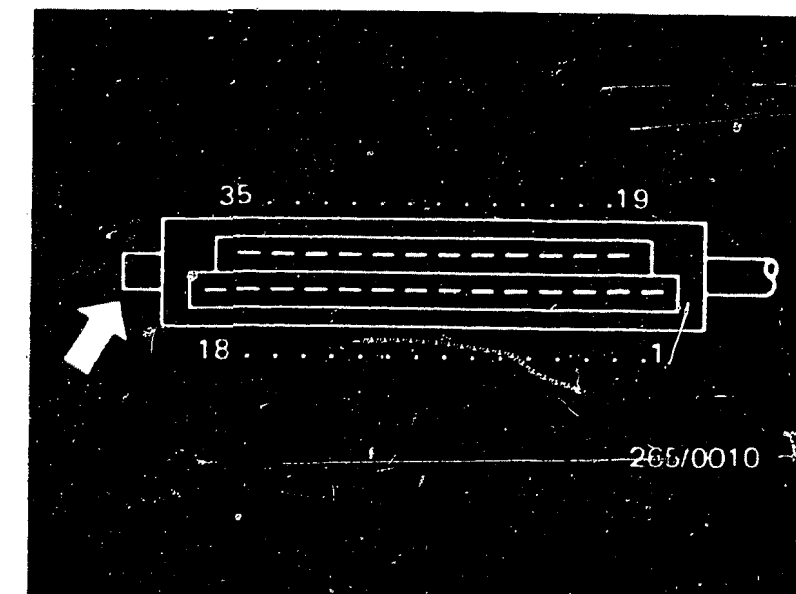
VR = Valve relay

MR = Motor relay

K4 = Wiring-harness plug

Top view of multiple plug K1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical encoding



Removing the hydraulic modulator:

- * For reasons of safety, the hydraulic modulator must not be repaired, but may only be completely replaced.

This does not include the motor and valve relay. Both relays may be replaced.

- * Except for the brake-line connections, no bolts on the hydraulic modulator may be loosened.

In particular, the Allen-head bolts (arrows) must on no account be loosened.

After loosening, the brake circuits can no longer be sealed!
This can be fatal!

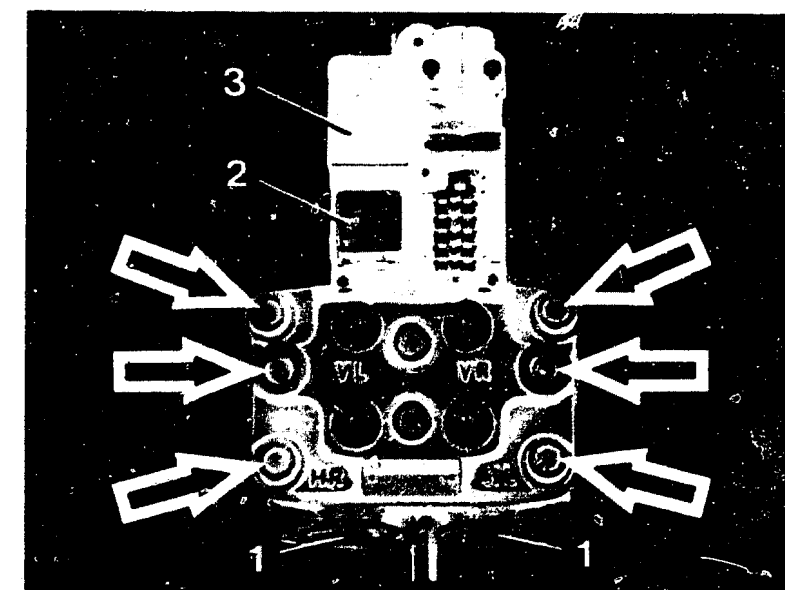
- * Visually inspect the hydraulic modulator and brake-line connections for leakage points.

If brake fluid is escaping, tighten (12...16 Nm) or replace the brake-line connections or install a new hydraulic modulator.



3 = Hydraulic modulator

- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Motor relay



Continued on next microimage

TEST STEP 18 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

*When removing and installing the brake lines, make sure that the lines are marked corresponding to the designations on the hydraulic modulator, and that they are correctly reconnected (for example, VL from hydraulic modulator must be connected to the left front wheel brake cylinder).

* Marking on hydraulic modulator:

- VL = Connection for left front brake line (wheel brake cylinder)
- VR = Connection for right front brake line (wheel brake cylinder)
- HR = Connection for right rear brake line (wheel brake cylinder)
- HL = Connection for left rear brake line (wheel brake cylinder)

*Use only the specified 9 x 11 mm double-headed box wrench for loosening

and tightening the brake lines:

*Mark the brake lines and detach them from the hydraulic modulator.

*Catch brake fluid. Do not allow it to get onto skin, clothes or paint!

*Immediately plug brake lines and connections with dummy plugs.

*Disconnect the ground lead (11) from the pump motor.

*Unscrew the fastening screw and remove the cover.

*Loosen the clip and pull out the plug.

*Unscrew hex nuts from holder (12) and take out the hydraulic modulator.

Installation

*Insert hydraulic modulator in holder and secure with the hex nuts.

*Connect ground lead to pump motor.

Connect 13-pin plug and secure with clip.

*Secure the cover (8) on the hydraulic modulator with screw (3)

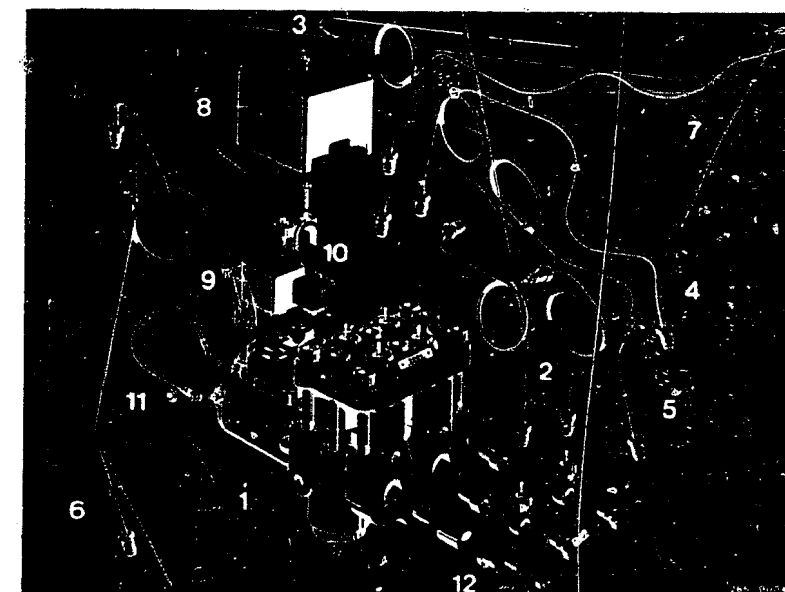
*Connect the brake lines to the hydraulic modulator corresponding to the markings.

*Observe the tightening torque (12...16 Nm) for the brake-line con-

nections at the hydraulic modulator.

*Bleed the brake system and test for sealing.

*Carry out a complete inspection of the ABS using the tester.



- 1 = Hydraulic modulator
- 2 = Brake lines to master cylinder
- 3 = Screw for cover
- 4 = Brake line to left rear fixed brake caliper
- 5 = Brake line to right rear fixed brake caliper
- 6 = Brake line to left front fixed brake caliper
- 7 = Brake line to right front fixed brake caliper
- 8 = Cover
- 9 = Motor relay
- 10 = Valve relay
- 11 = Ground lead for pump motor
- 12 = Holder

Continued on next microimage

TEST STEP 19

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Hydraulic modulator.

Diode in conducting direction.

N>

Operation:

Program-switch position: 15

Operation in vehicle:

Switch on ignition.

Test specification (reading):

2,5...8,5 V

Note:

ABS warning lamp lights up somewhat less brightly.

Valve relay switches.

Is the measured value within the test-specification tolerance range in each case ?

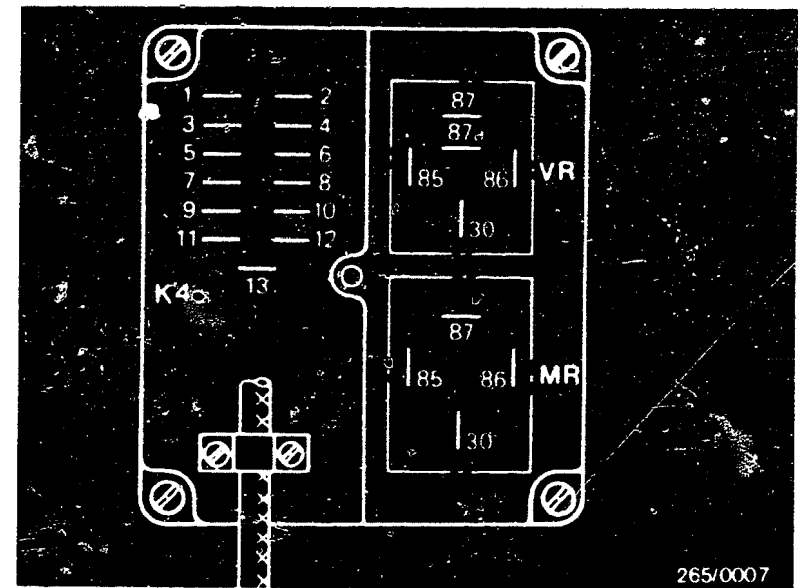
Trouble-shooting:

(switch off ignition)

Reading outside of tolerance range:

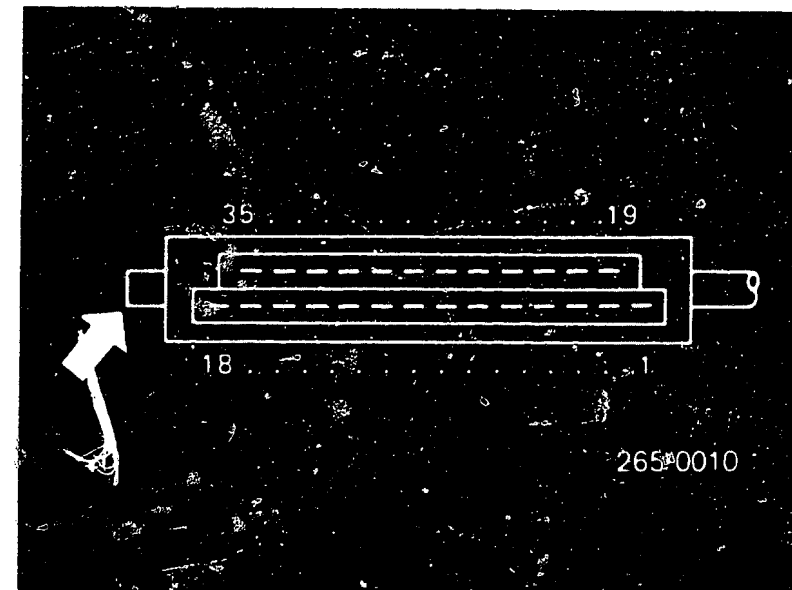
Test diode in conducting and non-conducting directions between K4/term.10 and K4/term.12 using ohmmeter.

If diode is defective, replace the hydraulic modulator.



Top view of plug-in printed-board assembly for hydraulic modulator. Position of terminals:
VR = Valve relay
MR = Motor relay
K4 = Wiring-harness plug

Top view of multiple plug K1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding



Continued F07

Continued on next coordinate

TEST STEP 19 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

Removing the hydraulic modulator:

- * For reasons of safety, the hydraulic modulator must not be repaired, but may only be completely replaced.

This does not include the motor and valve relay. Both relays may be replaced.

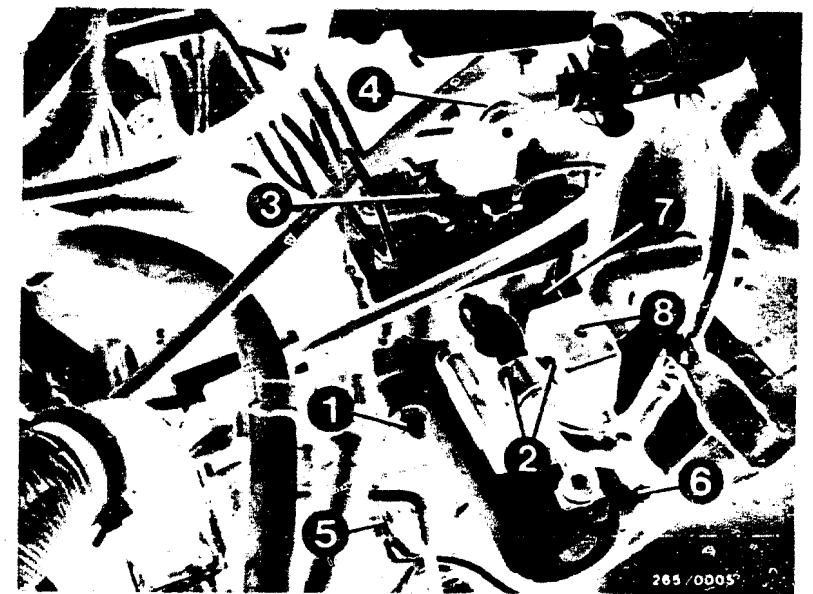
- * Except for the brake-line connections, no bolts on the hydraulic modulator may be loosened.

In particular, the Allen-head bolts (arrows) must on no account be loosened.

After loosening, the brake circuits can no longer be sealed!
This can be fatal!

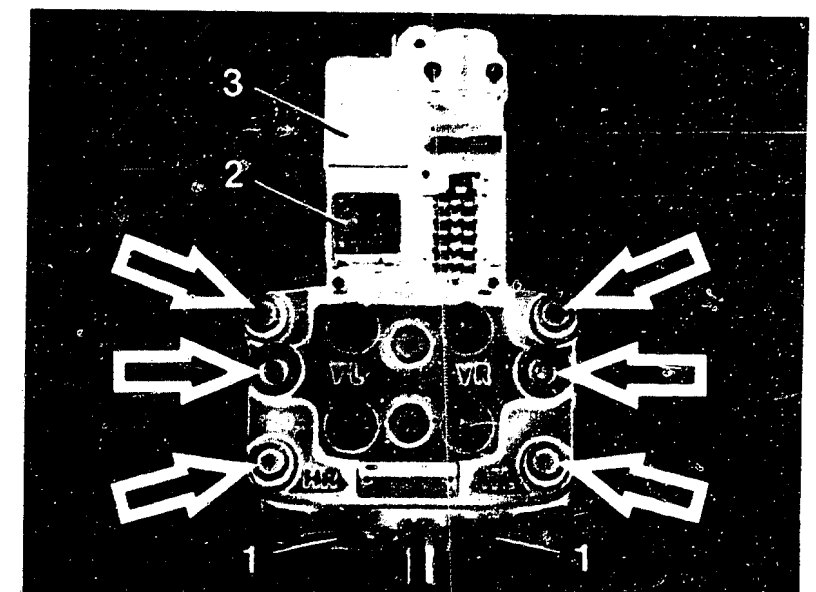
- * Visually inspect the hydraulic modulator and brake-line connections for leakage points.

If brake fluid is escaping, tighten (12...16 Nm) or replace the brake-line connections or install a new hydraulic modulator.



3 = Hydraulic modulator

- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Motor relay



Continued on next microimage

TEST STEP 19 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

*When removing and installing the brake lines, make sure that the lines are marked corresponding to the designations on the hydraulic modulator, and that they are correctly reconnected (for example, VL from hydraulic modulator must be connected to the left front wheel brake cylinder).

* Marking on hydraulic modulator:

- VL = Connection for left front brake line (wheel brake cylinder)
- VR = Connection for right front brake line (wheel brake cylinder)
- HR = Connection for right rear brake line (wheel brake cylinder)
- HL = Connection for left rear brake line (wheel brake cylinder)

*Use only the specified 9 x 11 mm double-headed box wrench for loosening

and tightening the brake lines:

*Mark the brake lines and detach them from the hydraulic modulator.

*Catch brake fluid. Do not allow it to get onto skin, clothes or paint!

*Immediately plug brake lines and connections with dummy plugs.

*Disconnect the ground lead (11) from the pump motor.

*Unscrew the fastening screw and remove the cover.

*Loosen the clip and pull out the plug.

*Unscrew hex nuts from holder (12) and take out the hydraulic modulator.

Installation

*Insert hydraulic modulator in holder and secure with the hex nuts.

*Connect ground lead to pump motor.

Connect 13-pin plug and secure with clip.

*Secure the cover (8) on the hydraulic modulator with screw (3)

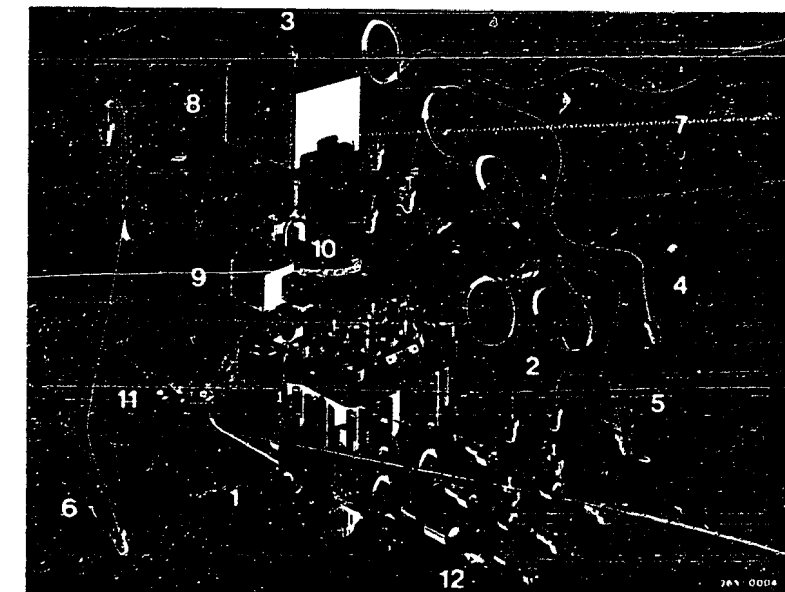
*Connect the brake lines to the hydraulic modulator corresponding to the markings.

*Observe the tightening torque (12...16 Nm) for the brake-line con-

nections at the hydraulic modulator.

*Bleed the brake system and test for sealing.

*Carry out a complete inspection of the ABS using the tester.



- 1 = Hydraulic modulator
- 2 = Brake lines to master cylinder
- 3 = Screw for cover
- 4 = Brake line to left rear fixed brake caliper
- 5 = Brake line to right rear fixed brake caliper
- 6 = Brake line to left front fixed brake caliper
- 7 = Brake line to right front fixed brake caliper
- 8 = Cover
- 9 = Motor relay
- 10 = Valve relay
- 11 = Ground lead for pump motor
- 12 = Holder

Continued on next microimage

TEST STEP 20

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Controller.

BITE triggering

(BITE = built-in test electronics)

N>

Operation:

Program-switch position: **16**

Illuminated button lights up.
Press button for at least 3 seconds.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

Observe ABS warning lamp inside vehicle:

After pressing the illuminated button, the warning lamp should go out within 1 second.

Warning lamp may flash 2 times.

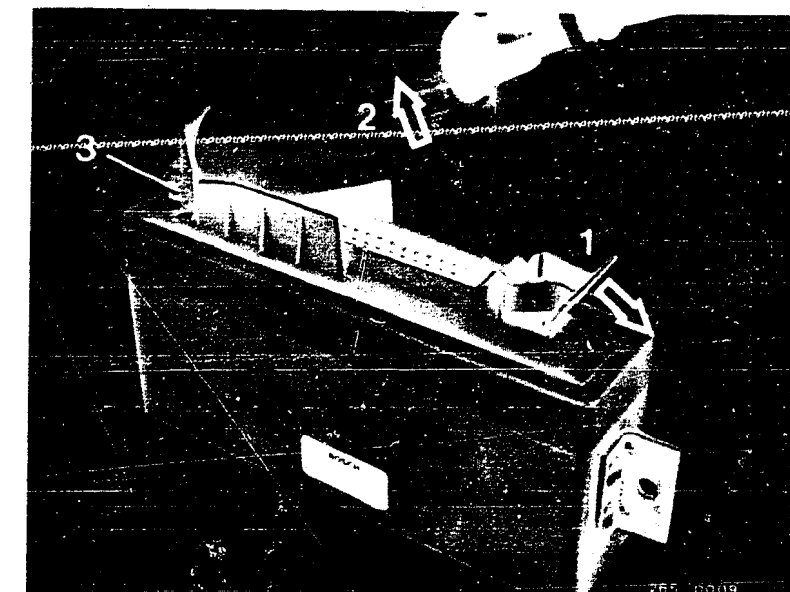
Does warning lamp go out within 1 seconds ?

Trouble-shooting:

1. Repeat test step with engine running.
2. Exchange controller (after switching off ignition).

Note:

- * Switch off ignition before disconnecting multiple plug.
- * To disconnect the multiple plug, push back the spring. Hinge multiple plug up and disengage from encoding unit.
- * Install only the specified controller!
- * When installing, make sure that the multiple plug engages in the spring.



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding unit

Continued on next coordinate

TEST STEP 21

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Controller.

BITE run with fault simulation.
(BITE = built-in test electronics)

N>

Operation:

Program-switch position: 17

Illuminated button lights up.
Press button at least 3 seconds.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

Observe ABS warning lamp inside vehicle.

Warning lamp should stay lit as long as the illuminated button is held down.

Warning lamp may flash 2 times.

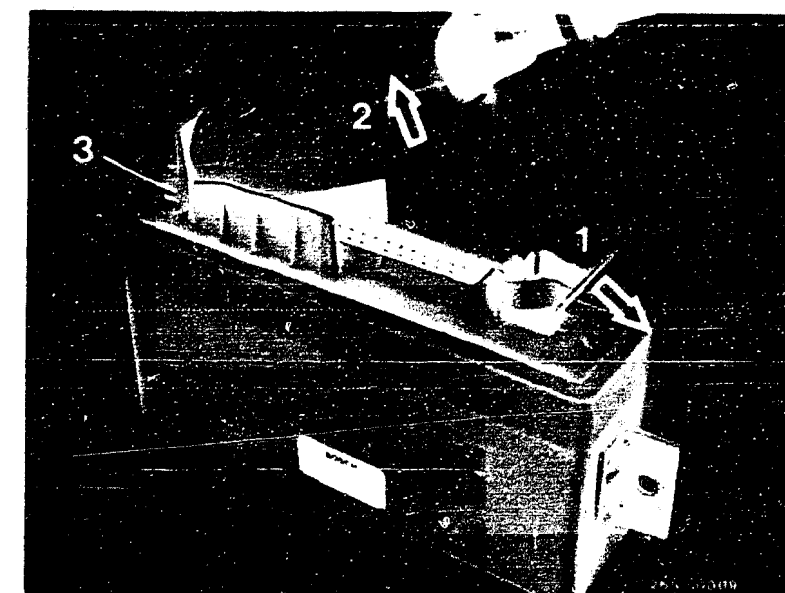
Does the warning lamp stay on as long as the illuminated button is held pressed ?

Trouble-shooting:

1. Repeat test step with engine running.
2. Exchange controller (after switching off ignition).

Note:

- * Switch off ignition before disconnecting multiple plug.
- * To disconnect the multiple plug, push back the spring. Hinge multiple plug up and disengage from encoding unit.
- * Install only the specified controller!
- * When installing, make sure that the multiple plug engages in the spring.



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding unit

Continued on next coordinate

Component/Function:

Controller.
Valve flows for maintaining pressure.

N>

Operation:

Program-switch position: **18**

Press the VL, VR, HL and HR channel buttons one after the other.

Illuminated button lights up.
Press the illuminated button after each channel button is pressed.

Note:

The reading must be zero before the illuminated button is pressed!

Operation in vehicle:

Switch on ignition.

Test specification (reading):

1,9...2,3 A
for each channel

Note:

Pump motor starts up.

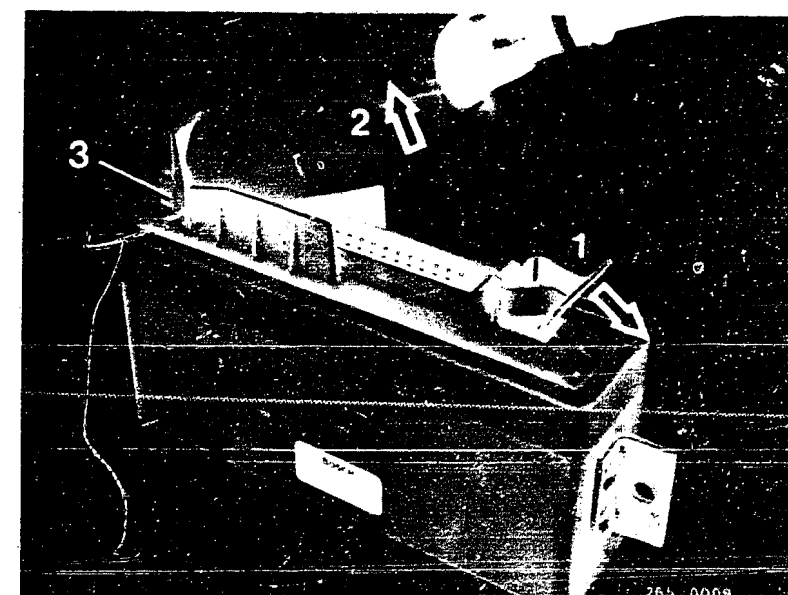
Is the measured value within the test-specification tolerance range in each case?

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace the control unit (first switch off the ignition).

Note:

- * After a few seconds the reading jumps to zero. If the test step is to be repeated, the button must be pressed again.
- * Switch off the ignition before disconnecting the multiple plug.
- * To pull the multiple plug, push back the spring.
Hinge the multiple plug upwards and disengage from the encoding unit.
- * Install only the specified controller!
- * When installing, make sure that the multiple plug engages in the spring.



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding unit

Continued on next coordinate

V

Component/Function:

Controller.

Valve flows for pressure reduction.

N>

Operation:

Program-switch position: 19

Press the VL, VR, HL and HR channel buttons one after the other.

Illuminated button lights up. Press the illuminated button after pressing each channel button.

Note:

The reading must be at zero before the illuminated button is pressed!

Operation in vehicle:

Switch on ignition.

Test specification (reading):

4,5...6,0 A
for each channel

Note:

Pump motor starts up.

Is the measured value within the test-specification tolerance range in each case?

Y

V

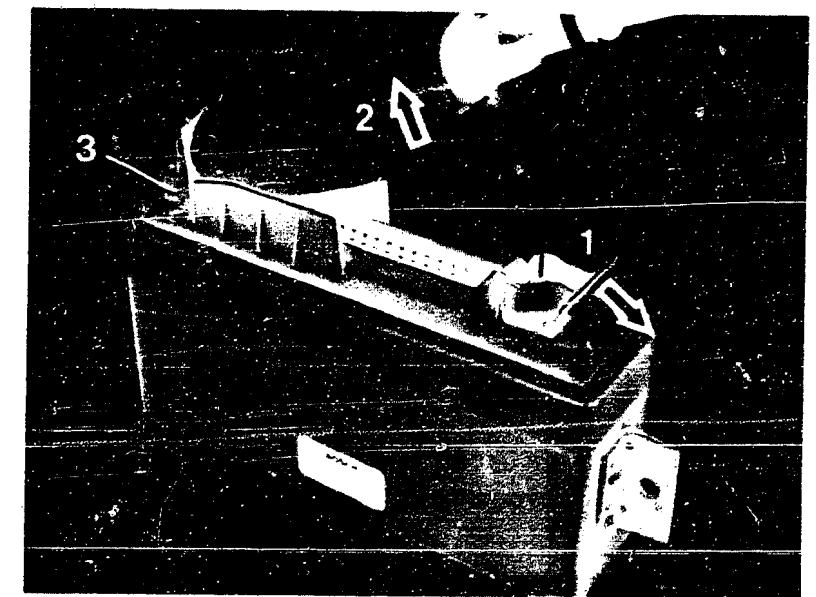
Continued on next coordinate

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace the control unit (first switch off the ignition).

Note:

- * After a few seconds the reading jumps to zero. If the test step is to be repeated, the button must be pressed again.
- * Switch off the ignition before disconnecting the multiple plug.
- * To pull the multiple plug, push back the spring. Hinge the multiple plug upwards and disengage from the encoding unit.
- * Install only the specified controller!
- * When installing, make sure that the multiple plug engages in the spring.



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding unit

TEST STEP 24

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Function:

Lead to stop-lamp switch.
Function built in as of 9.83
(Generation 2B).

N>

Operation:

Program-switch position: 24

Operation in vehicle:

Switch on ignition.
Depress brake pedal.

Test specification (reading):

10...15 V

Is the measured value within the
test-specification tolerance range?

Note:

The tester must be converted for
Generation 2B.
Marking U 2 or as of FD 352 on the
nameplate.

Y

V

Trouble-shooting:No reading:

Inspect stop-lamp switch including
plug connections and leads.

Reading below 10 V:

The brake lamps are defective.
Eliminate contact resistances at
plug connections or replace the
stop-lamp switch.

Continued on next coordinate

F15

<==>

F16

<==>

TEST STEP 24 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

A dynamic brake analyzer (brake test stand) (BPS) is necessary for program-switch positions 20, 21, 22 and 23.

I M P O R T A N T !

Never drive with the tester connected!

Do not use a brake-pedal-actuating device to set the braking force!

Proceed with program-switch position 23 first, since the following test steps require that the wheel-speed sensors be in proper working order.

When switching channels, wait at least 20 seconds (internal tester program must complete).

Always observe the operating sequence.

Begin testing with the front axle.

For reasons of safety, it is vital that the tester be converted to the latest status.

Make sure of U2 marking, or as of FD 352 on the nameplate!

Continued on next microimage

TEST STEP 25

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Left front wheel-speed sensor.
Signal and transposition of
connection leads.

N>

Operation:

Program-switch position: 23

- * Drive the vehicle onto the brake test stand with the front wheels.
- * Pull the parking brake.
- Important!**
On vehicles with automatic transmission, make sure that the selector level is in the "N" position.
- * Select left front wheel with button VL.
- * Switch on the left brake roller.
- * Note the reading.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

1,7...19

If the reading fluctuates, the lowest value applies!

If the reading is at 1,7
bridge the air gap!

Is the measured value within the test-specification tolerance range ?

Trouble-shooting:
(Switch off ignition)

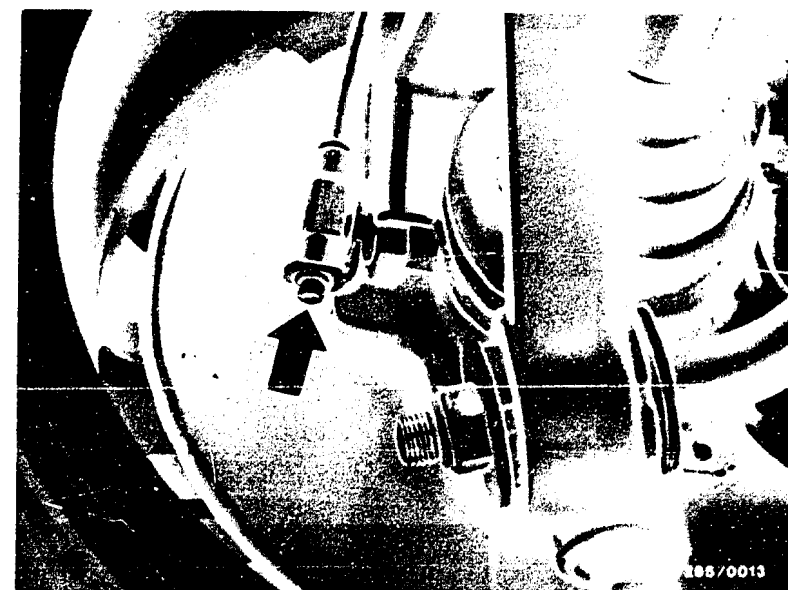
A reading of 999 means:

Brake test stand speed excessive
(above approx. 13 km/h).



Arrow = Wheel-speed sensor
plug connection in
engine compartment

Arrow : Fastening screw for
wheel-speed sensor



Continued F25

Continued on next coordinate

F19

<—>

F20

<—>

Reading 0 or less than 1,7

- * Wheel-speed sensor incorrectly connected (transposed)?
Check routing: wheel-speed sensors must correspond to the prescribed wheel and controller inputs (see circuit diagram).
- * Is the air gap between the wheel-speed sensor and ring gear too large?
Check installation: is there a plastic cap on the wheel-speed sensor blade and is it correctly mounted?
Is the wheel-speed sensor inserted all the way to stop?
- * Check wheel-bearing clearance.
- * Replace wheel-speed sensor.

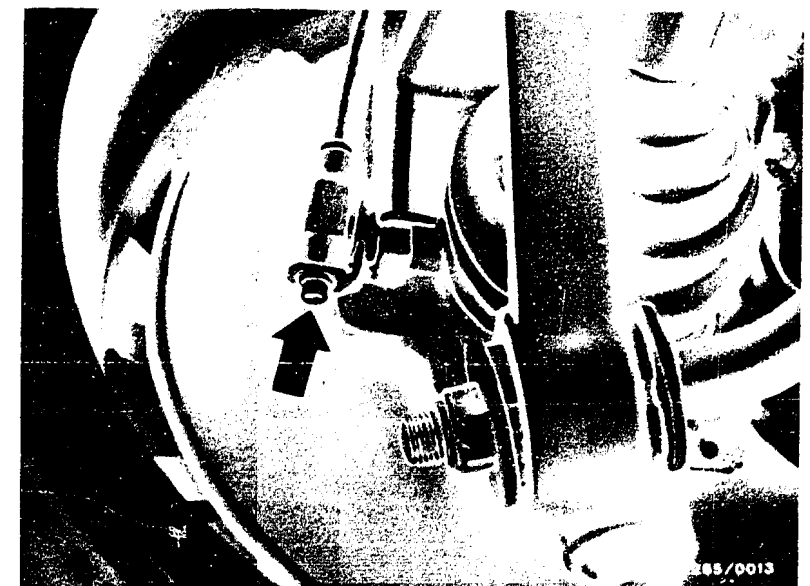
Removing front-axle wheel-speed sensors

- * Disconnect wheel-speed sensor plug connection in engine compartment.
- * Installation position of plug connections:
In engine compartment on left and right at firewall.
- * Pull plug connection out of holder and disconnect.
- * Loosen cable fasteners.
- * Unscrew the fastening screw for the wheel-speed sensor and pull the sensor out. Do not use force!



Arrow = Wheel-speed sensor plug connection in engine compartment

Arrow : Fastening screw for wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the front axle

- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike!
The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw.
Tighten the fastening screw to 6...8 Nm.
During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reattach at the places provided.

Note:

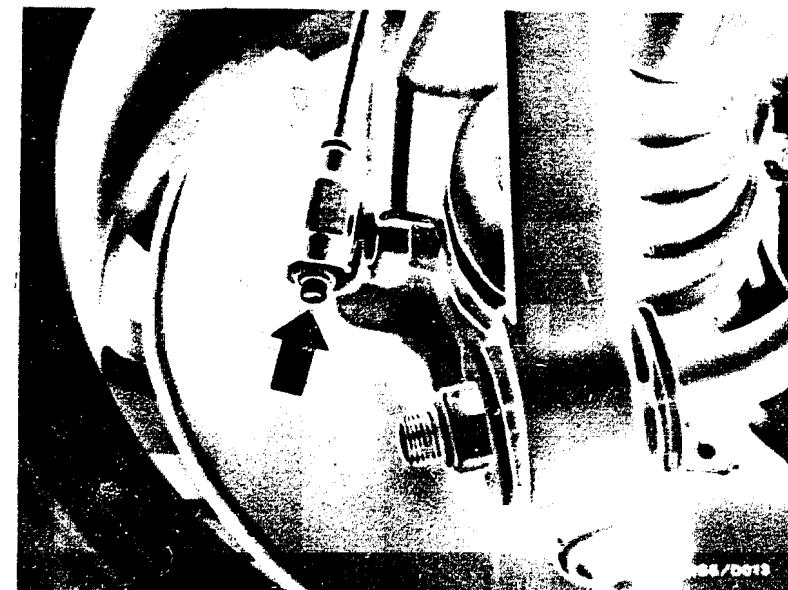
The fastening point for the wheel-speed sensor cable on the wheel-bearing housing is marked with a white and red stripe.

- * Connect the wheel-speed sensor with the ABS wiring harness.

I M P O R T A N T !

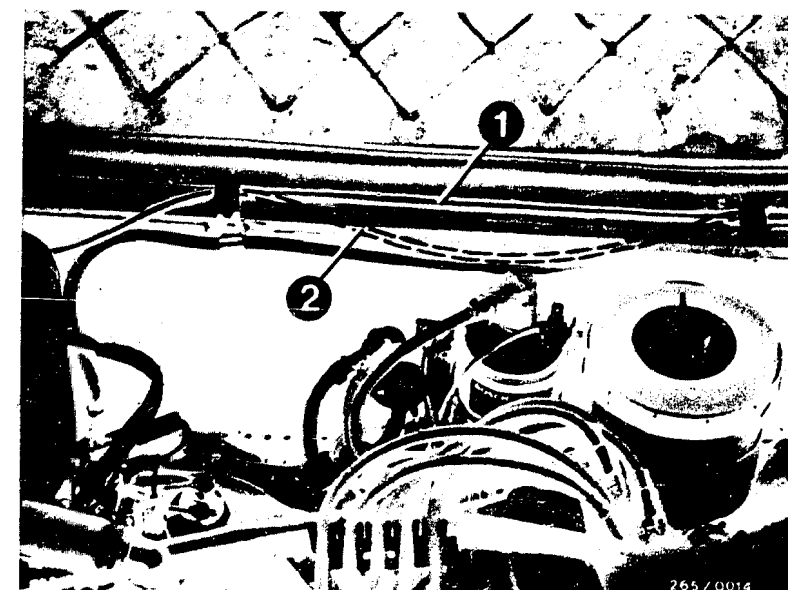
- * Observe lead routing over the ignition coil!
The lead must not hang down!
If necessary, provide additional fastening.
- * After repair, carry out testing using the ABS tester.

Continued on next microimage



Arrow : Fastening screw for wheel-speed sensor

- 1 = Correct lead routing
- 2 = Incorrect lead routing



TEST STEP 26

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Right front wheel-speed sensor.
Signal and transposition of
connection leads.

N>

Operation:

Program-switch position:

23

- * Drive vehicle onto brake test stand with front wheels.
- * Pull the parking brake.

Important:

With vehicles having automatic transmission, make sure that the selector level is in the "N" position.

- * Select right front wheel with button VR.
- * Switch off the left brake roller and switch on the right brake roller.
- * Note reading.

Operation in vehicle:

Switch off ignition.

Test specification (reading):

1,7...19

If the reading fluctuates, the lowest value applies!

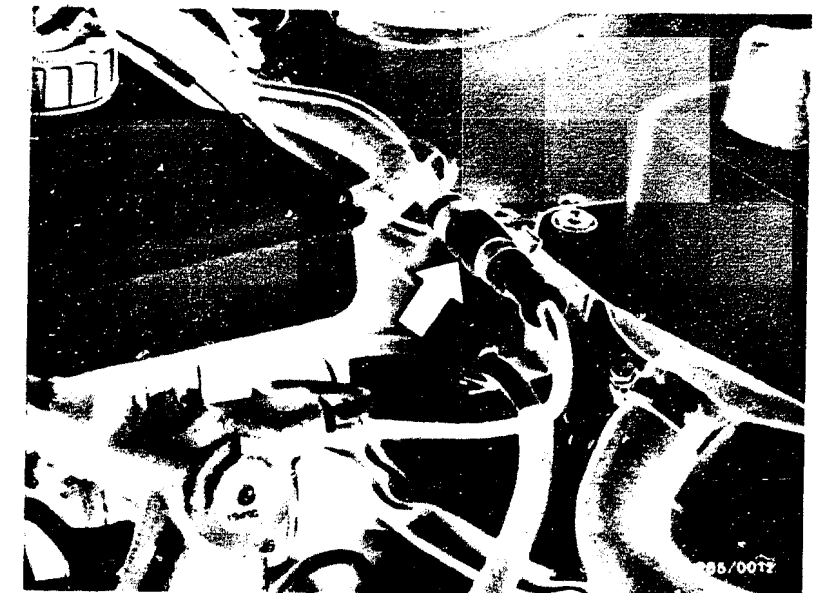
If the reading is at 1,7 bridge the air gap!

Is the measured value within the test-specification tolerance range in each case ?

Trouble-shooting: (Switch off ignition)

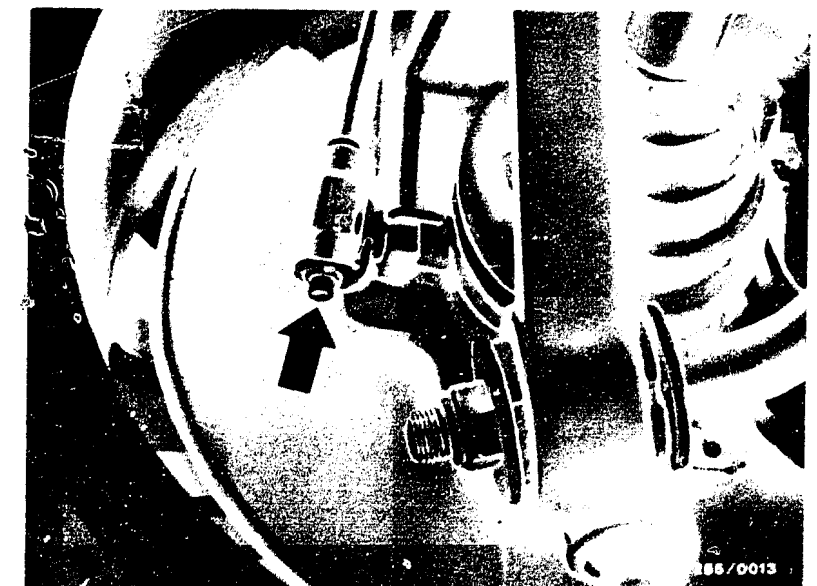
A reading of 999 means:

Brake test stand speed excessive
(above approx. 13 km/h).



Arrow = Wheel-speed sensor
plug connection in
engine compartment

Arrow : Fastening screw for
wheel-speed sensor



Continued G03

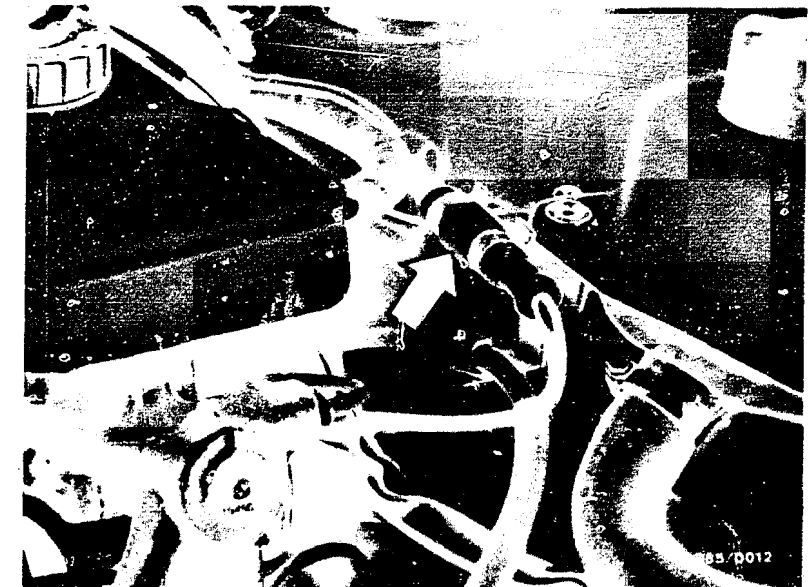
Continued on next coordinate

Reading 0 or less than 1.7

- * Wheel-speed sensor incorrectly connected (transposed)?
Check routing: wheel-speed sensors must correspond to the prescribed wheel and controller inputs (see circuit diagram).
- * Is the air gap between the wheel-speed sensor and ring gear too large?
Check installation: is there a plastic cap on the wheel-speed sensor blade and is it correctly mounted?
Is the wheel-speed sensor inserted all the way to stop?
- * Check wheel-bearing clearance.
- * Replace wheel-speed sensor.

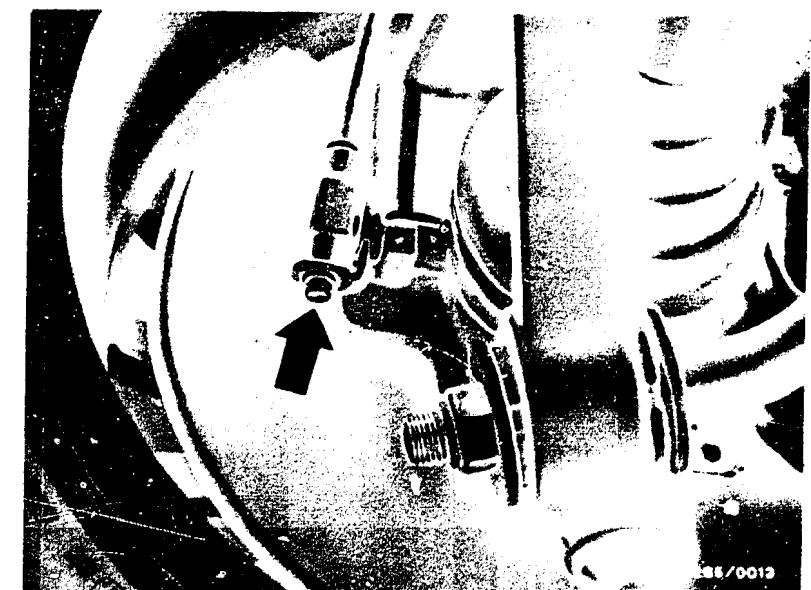
Removing front-axle wheel-speed sensors

- * Disconnect wheel-speed sensor plug connection in engine compartment.
- * Installation position of plug connections:
In engine compartment on left and right at firewall.
- * Pull plug connection out of holder and disconnect.
- * Loosen cable fasteners.
- * Unscrew the fastening screw for the wheel-speed sensor and pull the sensor out. Do not use force!



Arrow = Wheel-speed sensor
plug connection in
engine compartment

Arrow : Fastening screw for
wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the front axle

- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike! The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw. Tighten the fastening screw to 6...8 Nm. During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reattach at the places provided.

Note:

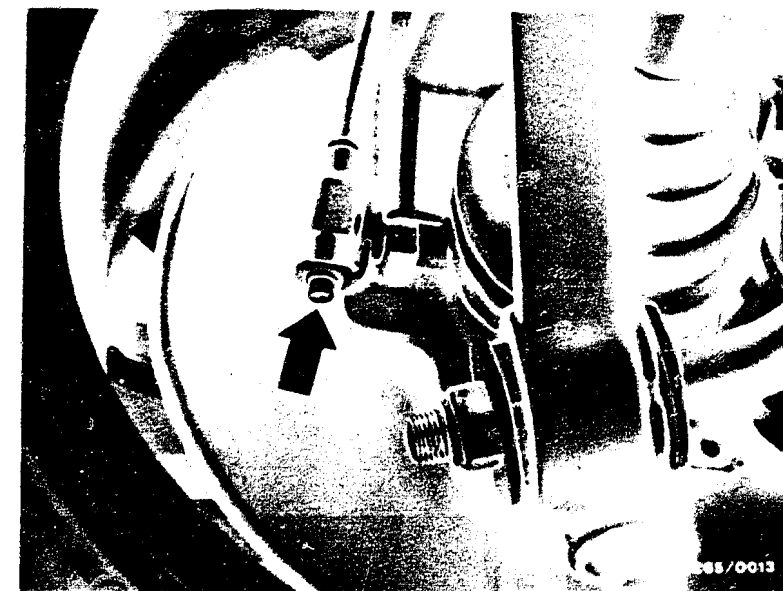
The fastening point for the wheel-speed sensor cable on the wheel-bearing housing is marked with a white and red stripe.

- * Connect the wheel-speed sensor with the ABS wiring harness.

I M P O R T A N T !

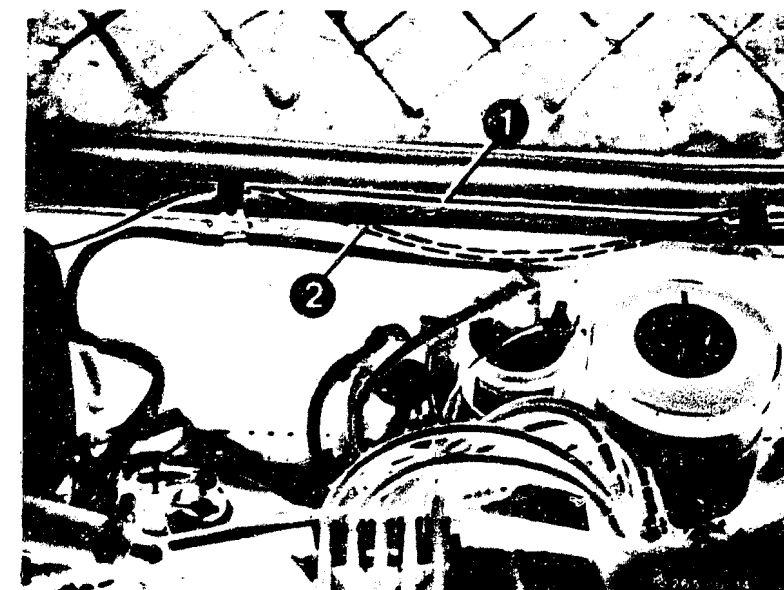
- * Observe lead routing over the ignition coil! The lead must not hang down! If necessary, provide additional fastening.
- * After repair, carry out testing using the ABS tester.

Continued on next microimage



Arrow : Fastening screw for wheel-speed sensor

1 = Correct lead routing
2 = Incorrect lead routing



Component/Function:

Hydraulic modulator.
Check for correct connection of
brake lines at front axle.

N>

Operation:

Program-switch position: 20

- * Select left front wheel with button VL.
- * Switch on the left brake roller.
- * Depress the brake pedal until the braking-force reading on the brake test stand is 2000 N (200 kp).
- * Press the illuminated button.
- * There must be a pressure drop at the selected wheel (left front).
- * Release the brake pedal and illuminated button (in that order - otherwise the vehicle will jump out of the rollers).

Operation in vehicle:

Let engine run.

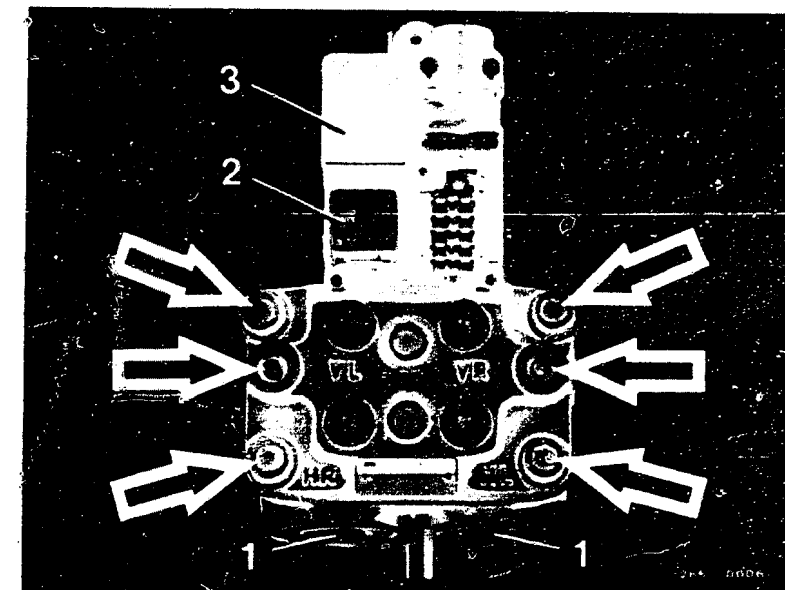
Test specification (reading):

BPS reading for left wheel:
less than 1100 N (110 kp).

Is the measured value
below 1100 N ?

Trouble-shooting:

- * Lamp 2 (red) must not light up.
- * Repeat testing.
- * Are the brake lines mixed up at the hydraulic modulator ?
Observe markings.
- * Test correspondence of brake rollers to buttons VR and VL again.



- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Motor relay
- VL = Connection for left front brake line (wheel brake cylinder)
- VR = Connection for right front brake line (wheel brake cylinder)
- HR = Connection for right rear brake line (wheel brake cylinder)
- HL = Connection for left rear brake line (wheel brake cylinder)

IMPORTANT !

The Allen screws (arrows) must never be loosened. If they are loosened, the brake circuit can no longer be sealed.
This can be fatal!

Continued on next coordinate

Component/Function:

Hydraulic modulator.

Test of correct connection of brake lines at the front axles.

N>

Operation:

Program-switch position: 20

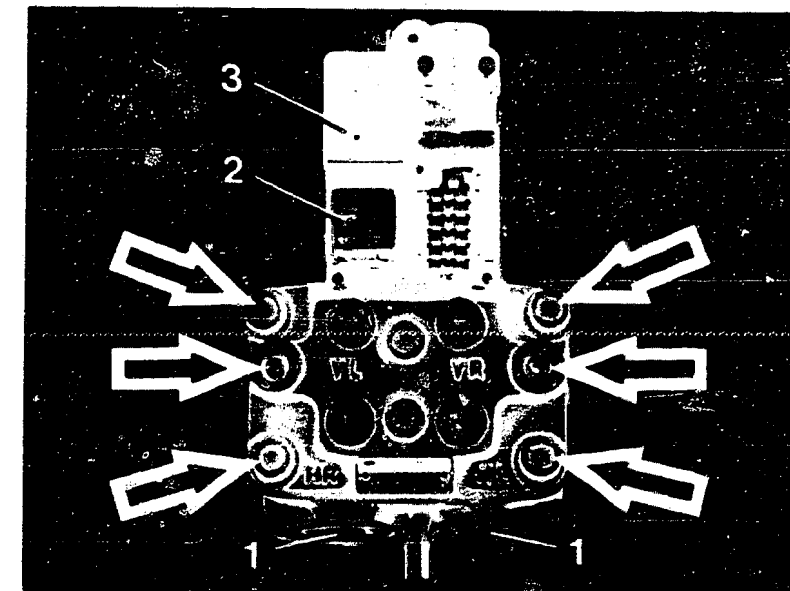
- * Select right front wheel with button VR.
- * Switch off the left brake roller, switch on the right brake roller.
- * Depress the brake pedal until the braking-force reading on the brake test stand is 2000 N (200 kp).
- * Press illuminated button.
- * There must be a pressure drop at the selected wheel (right front).
- * Release the brake pedal and illuminated button (in that order - otherwise the vehicle will jump out of the rollers).

Operation in vehicle:

Let engine run.

Test specification (reading):BPS reading for right wheel:
less than 1100 N (110 kp)Is the measured value
below 1100 N ?Trouble-shooting:

- * Lamp 2 (red) must not light up.
- * Repeat testing.
- * Are the brake lines mixed up at the hydraulic modulator ?
Observe markings.
- * Test correspondence of brake rollers to buttons VR and VL again.



- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Motor relay
- VL = Connection for left front brake line (wheel brake cylinder)
- VR = Connection for right front brake line (wheel brake cylinder)
- HR = Connection for right rear brake line (wheel brake cylinder)
- HL = Connection for left rear brake line (wheel brake cylinder)

IMPORTANT !

The Allen screws (arrows) must never be loosened. If they are loosened, the brake circuit can no longer be sealed. This can be fatal!

Continued on next coordinate

Component/Function:

Hydraulic modulator.

Test of pressure reduction in left front wheel brake cylinder.

Operation:

Program-switch position:

T20

N>

- * Switch on the left and right brake rollers.
- * Select wheel VL with button VL.
- * Depress brake pedal until the brake test stand instrument indicates 200 0 N (200 kp) for left.
The pedal braking force must not be changed during the entire test!
- * The right reading can deviate from the left reading by max. 500 N (50 kp).
- * Keep illuminated button depressed until testing is over (approx. 10 seconds).
- * Note left reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

Test specification (reading):

BPS reading for left wheel less than 1100 N (110 kp).

Is the measured value less than 1100 N?

Trouble-shooting:

- * Lamp 2 (red) must not light up.
- * Repeat testing twice and make sure that the braking force is not altered during testing.
- * Is the rest of the brake system OK ? Well bleed ?
Are the brake-line connections sealed ? Are the brake linings OK ?
The brake linings must not be "glassy".
Are the brake disks OK ?
The brakes must be generally "grippy".
Are the master and wheel cylinders OK ?
The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Check the ground terminal on the pump motor and the body.
- * Check the positive terminal on the pump motor.
- * Replace the hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

Component/Function:

Hydraulic modulator.

Test of pressure reduction in right front wheel brake cylinder.

N>

Operation:

Program-switch position:

20

- * Switch on the left and right brake rollers.
- * Select the right front wheel with the VR button.
- * Depress the brake pedal until the brake test stand instrument shows 20 00 N (200 kp), for right.
- The pedal braking force must not be changed during the entire test!
- * The right reading may deviate from the left reading by max. 500 N (50 kp).
- * Depress the illuminated button until testing is over (approx. 10 seconds).
- * Read the right reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

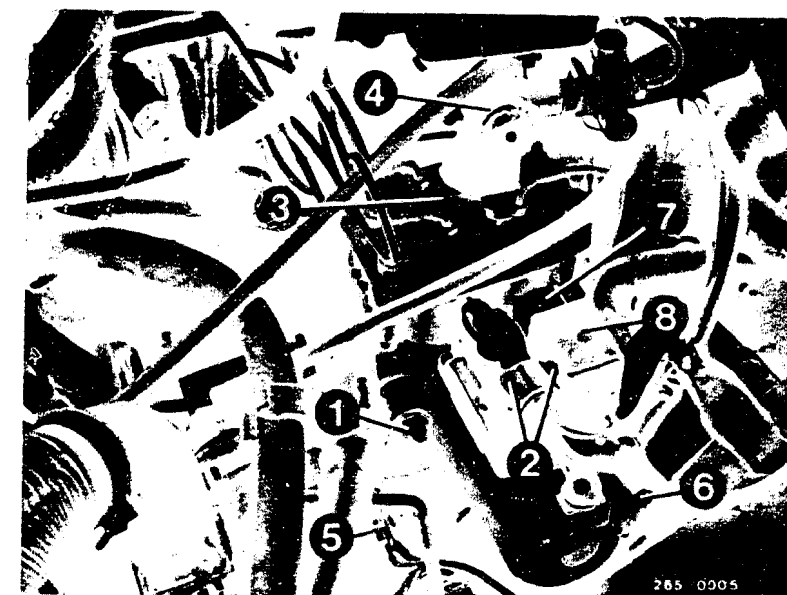
Test specification (reading):

BPS reading for right wheel less than 1100 N (110 kp).

Is the measured value below 1100 N ?

Trouble-shooting:

- * Lamp 2 (red) must not light up.
- * Repeat the test twice. Make sure that the braking force mains unaltered during the entire test (let engine run).
- * Is the rest of the brake system OK ? Well ventilated ? Are the brake-line connections sealed ? Brake linings OK ? Brake linings must not be "glassy". Brake disks OK ? The brakes must be generally "grippy". Are the main and wheel brake cylinders OK ? The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Inspect the ground terminals on the pump motor and body.
- * Check positive terminal at pump motor.
- * Replace the hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

Component/Function:

Hydraulic modulator
Test of pressure buildup in left
front wheel brake cylinder.

N>

Operation:

Program-switch position:

21

- * Switch on both brake rollers.
- * Select the left front wheel with button VL.
- * Depress brake pedal until brake test stand instrument shows 2000 N (200 kp) at left.
- * The pedal braking force must not change during the entire test!
- * Depress illuminated button until testing is over (approx. 10 seconds).
- * Read the left reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

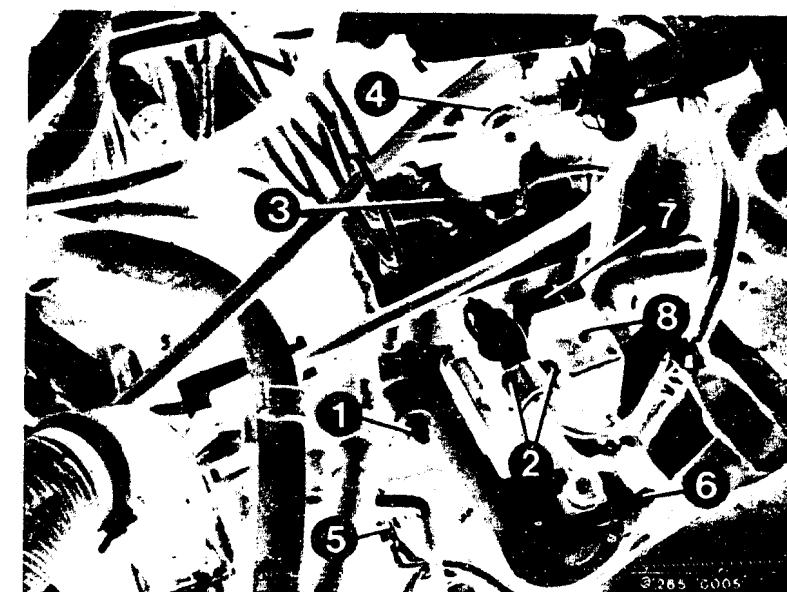
Test specification (reading):

BPS reading for the left wheel goes back to an intermediate value and then rises to 600...1700 N (60...170 kp).

Is the measured value OK ?

Trouble-shooting:

- * Repeat testing twice and make sure that the braking force is not altered during testing (let engine run).
- * Is the rest of the brake system OK? Well ventilated ? Are the brake-line connections sealed ? Brake linings OK ? The brake linings must not be "glassy". Brake disks OK ? The brakes must be generally "grippy". Are the master and wheel brake cylinders OK ? The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Inspect the ground terminals on the pump motor and the body.
- * Check positive terminal on pump motor.
- * Replace the hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

Component/Function:

Hydraulic modulator.
Test of pressure buildup in
right front wheel brake cylinder.

N>

Operation:

Program-switch position: 21

- * Switch on both brake rollers.
- * Select the right front wheel with button VR.
- * Depress brake pedal until test stand instrument shows 2000 N (200 kp) for right.
- * The pedal braking force must not be changed during the entire test!
- * Depress the illuminated button until testing is over (approx. 10 seconds).
- * Note the right reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

Test specification (reading):

BPS reading for right wheel goes back to an intermediate value and then climbs to 600...1700 N (60...170 kp).

Is the measured value OK ?

Trouble-shooting:

- * Repeat testing twice and make sure that the braking force is not altered during testing (let engine run).
- * Is the rest of the brake system OK? Well ventilated ? Are the brake-line connections sealed ? Brake linings OK ? The brake linings must not be "glassy". Brake disks OK ? The brakes must be generally "grippy". Are the master and wheel brake cylinders OK ? The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Inspect the ground terminals on the pump motor and the body.
- * Check positive terminal on pump motor.
- * Replace the hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

Component/Function:

Hydraulic modulator.

Pump delivery in 1st brake circuit.

N>

Operation:

Program-switch position: 22

- * Switch on both brake rollers.
- * Note rolling friction of left wheel.
- * Select left front wheel with button VL.
- * Depress brake pedal until brake test stand instrument shows 2000 N (200 kp) for left.
- * Pedal braking force must not be changed during the entire test!
- * Depress the illuminated button until testing is over (approx. 10 seconds).
- * Note left reading.
- * Release brake pedal and illuminated button (in that order.)

Operation in vehicle:

Let engine run.

Test specification (reading):

The BPS reading for the left wheel must drop below the rolling friction plus
max. 200 N (20 kp). 1)
Is the measured value OK ?

1) Note:

After pressing the illuminated button, there will be pressure reduction 2 times without return pump.

The return pump will then briefly switch on.

The brake pedal will then show noticeable return pressure.

Do not note the test value until within approx. 2,5 seconds after the return pump has switched on.

Depress the illuminated button until the reading returns to full braking force.

Trouble-shooting:

- * Repeat test twice and make sure that the braking force is not altered during testing (let engine run).
- * Is the rest of the brake system OK ? Well ventilated ? Are the brake-line connections sealed ? Brake linings OK ? The brake linings must not be "glassy". Are brake disks OK ? The brakes must be generally "grippy". Are the main and wheel brake cylinders OK ? The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Inspect ground terminals on pump motor and body.
- * Check positive terminal at pump motor.
- * Replace hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

Component/Function:

Hydraulic modulator.
Pump delivery in 2nd brake circuit.

N>

Operation:

Program-switch position:

22

- * Switch on both brake rollers.
- * Note the rolling resistance of the right wheel.
- * Select the right front wheel with button VR.
- * Depress brake pedal until the brake test stand instrument shows 2000 N (200 kp) for right wheel.
- * The pedal braking force must not be changed during the entire test!
- * Depress illuminated button until testing is over (approx. 10 seconds).
- * Note right reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

Test specification (reading):

BPS reading for right wheel must fall below the rolling resistance plus

max. 200 N (20 kp). 1)

Is the measured value OK ?

1) Note:

After pressing the illuminated button, there will be pressure reduction 2 times without return pump.

The return pump will then briefly switch on.

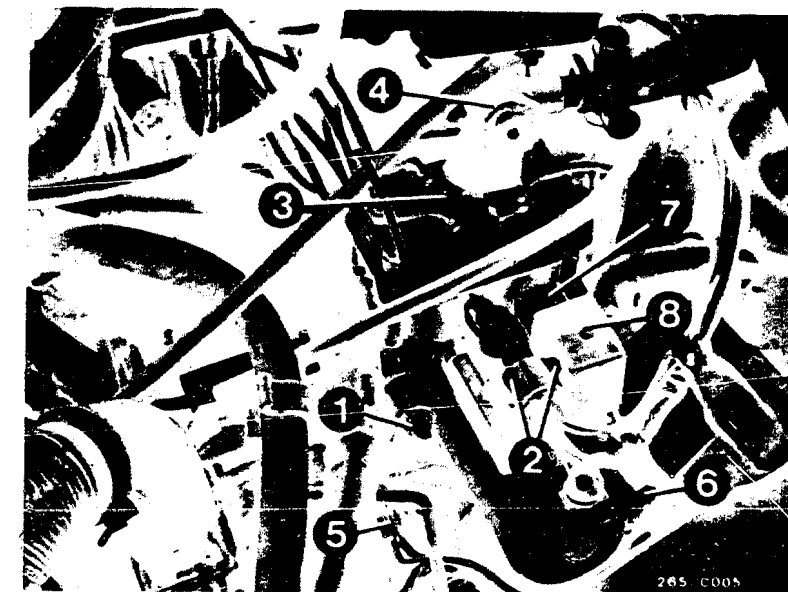
The brake pedal will then show noticeable return pressure.

Do not note the test value until within approx. 2,5 seconds after the return pump has switched on.

Depress the illuminated button until the reading returns to full braking force.

Trouble-shooting:

- * Repeat test twice and make sure that the braking force is not altered during testing (let engine run).
- * Is the rest of the brake system OK ? Well ventilated ? Are the brake-line connections sealed ? Brake linings OK ? The brake linings must not be "glassy". Are brake disks OK ? The brakes must be generally "grippy". Are the main and wheel brake cylinders OK ? The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Inspect ground terminals on pump motor and body.
- * Check positive terminal at pump motor.
- * Replace hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

TEST STEP 35

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Left rear wheel-speed sensor.
Signal and transposition of
connection leads.

N>

Operation:

Program-switch position: **23**

- * Drive vehicle onto brake test stand with rear wheels.
- * Release parking brake.
- Important:
On vehicles with automatic transmission, the selector lever must be in park.
- * Select left rear wheel with button HL.
- * Switch on left brake roller.
- * Note reading.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

1,7...19

If the reading fluctuates, the
lowest value applies!

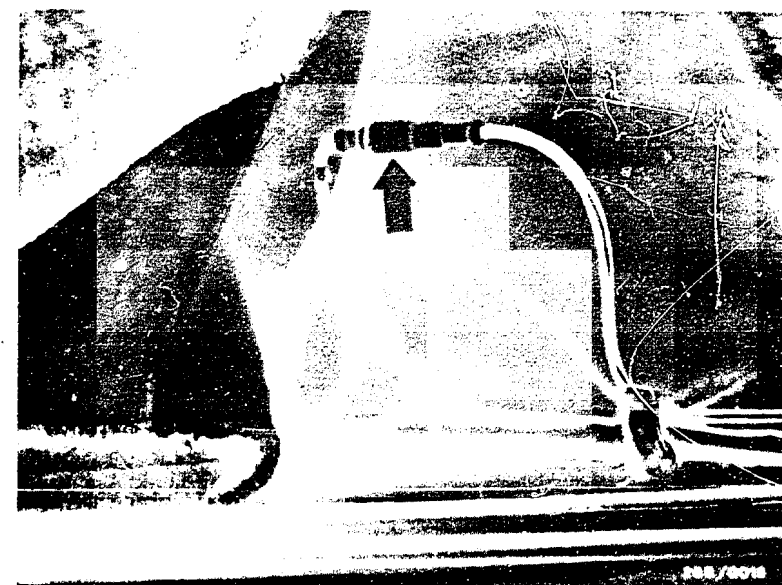
If reading at 1,7
inspect air gap!

Is the measured value within the
test-specification tolerance
range?

Trouble-shooting:
(Switch off ignition)

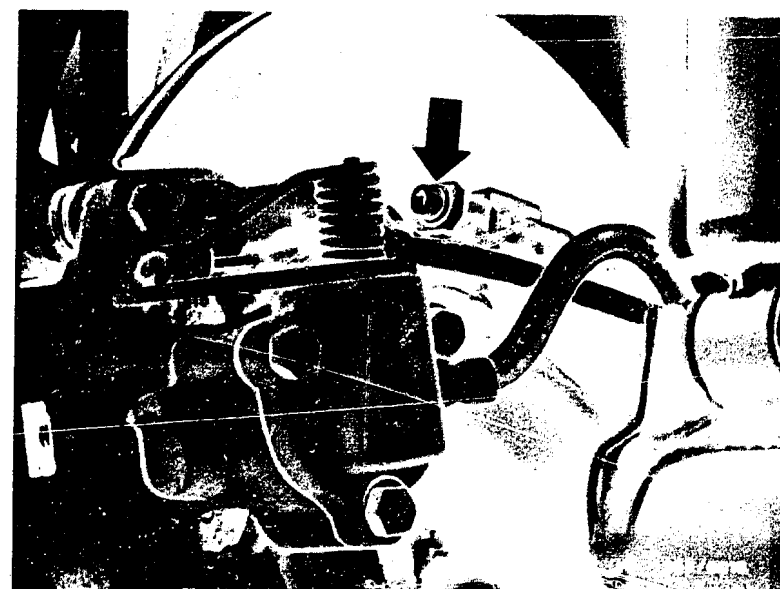
A reading of 999 means:

Brake test stand speed excessive
(above approx. 13 km/h).



Arrow = Wheel-speed sensor -
plug connection below
rear seat in Audi 200

Arrow = Fastening screw for
wheel-speed sensor



Continued G25

Continued on next coordinate

G19

<—>

G20

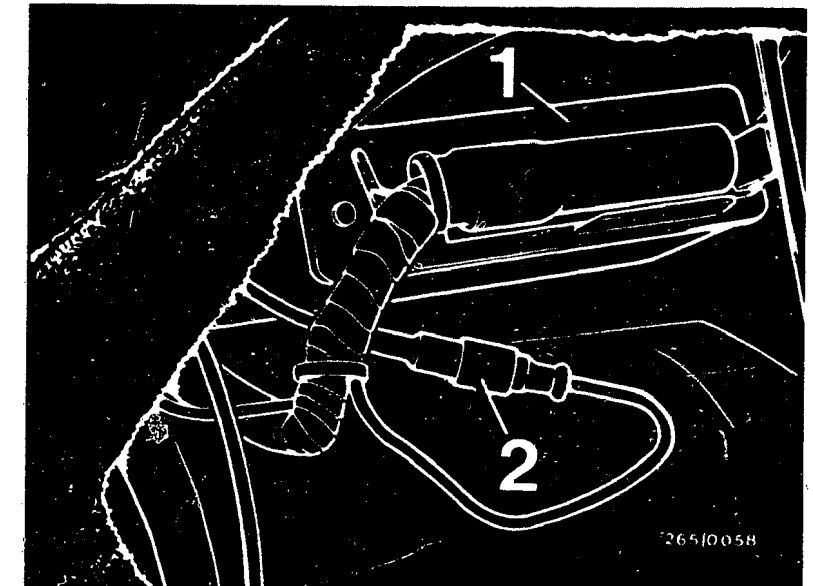
<—>

Reading 0 for less than 1,7

- * Are wheel-speed sensors transposed (incorrectly connected)?
Check connection: The wheel-speed sensors must correspond to the specified wheel and controller inputs (see circuit diagram).
- * Is the air gap between the wheel-speed sensor and ring gear excessive?
Check installation: Is there a plastic cap on the wheel-speed blade and is it correctly positioned?
Is the wheel-speed sensor installed all the way to stop?
- * Inspect wheel-bearing clearance.
- * Replace wheel-speed sensor.

Removing wheel-speed sensors on rear axle

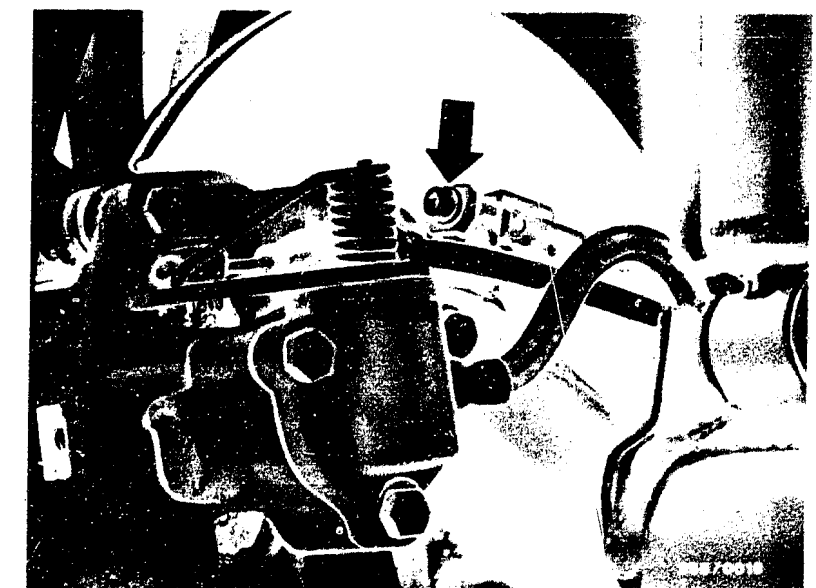
- * Disconnect the wheel-speed sensor plug connection under the rear seat.
- * Remove the rear seat.
Unscrew cover strip from ridge.
Turn back carpeting and disconnect plug connection.
- * Unscrew the lead fasteners on the superstructure in the rear compartment and trailing arms of rear axle.
- * Unscrew the wheel-speed sensor fastening screw and pull out wheel-speed sensor.
Do not use force!



In the Audi 100 und Audi 200 (from 9,83)

- 1 = Controller below rear seat
- 2 = Wheel-speed sensor plug connection

Arrow = Fastening screw for wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the rear axles

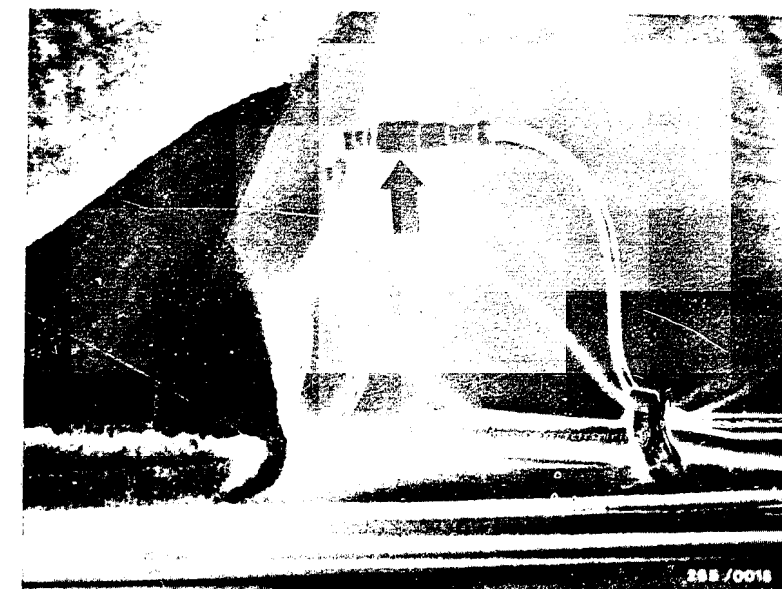
- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike! The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw. Tighten the fastening screw to 6...8 Nm. During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reattach at the places provided.

Note:

The fastening points of the wheel-speed-sensor lead on the trailing arms of the rear axle are marked with a white and red stripe.

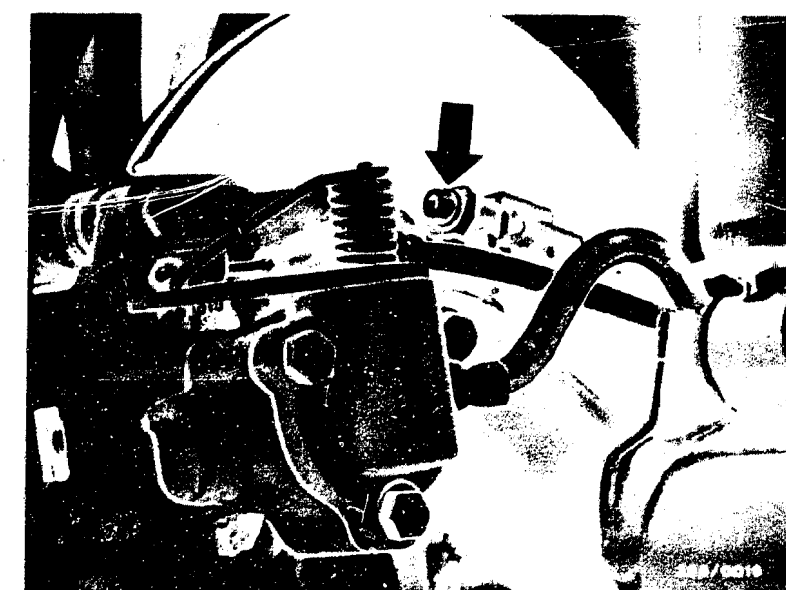
- * Connect wheel-speed sensor to ABS wiring harness.
- * After repair, test with the ABS tester.

Continued on next microimage



Arrow = Wheel-speed sensor –
plug connection below
rear seat in Audi 200

Arrow = Fastening screw for
wheel-speed sensor



Component/Function:

Right rear wheel-speed sensor.
Signal and transposition (incorrect connection) of connection leads.

N>

Operation:

Program-switch position: **23**

- * Drive the vehicle onto the brake test stand with rear wheels.
- * Release the parking brake.

Important!

On vehicles with automatic transmission, the selector lever must be in park.

- * Select right rear wheel with button HR.
- * Switch off the left brake roller.
- * Switch on the right brake roller.
- * Note reading.

Operation in vehicle:

Switch on ignition.

Test specification (reading):

1,7...19

If the reading fluctuates, the lowest value applies!

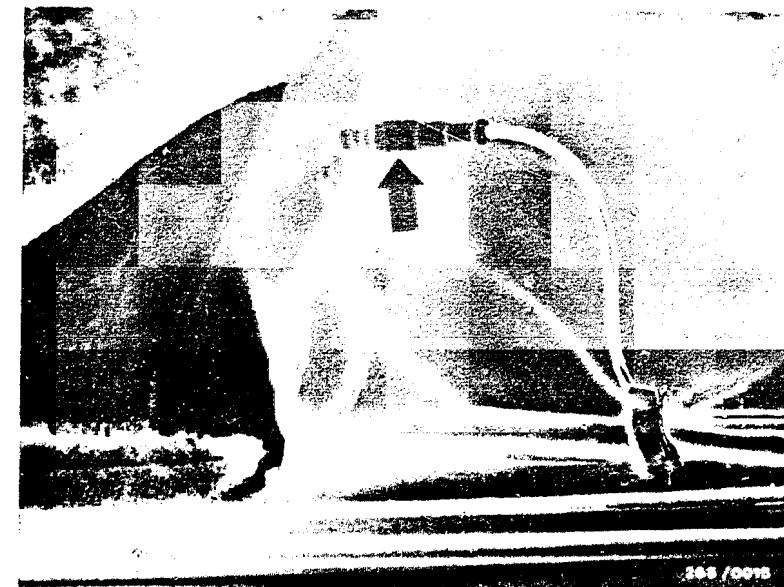
If reading at 1,7 check air gap!

Is the measured value within the test-specification tolerance range?

Trouble-shooting:
(Switch off ignition)

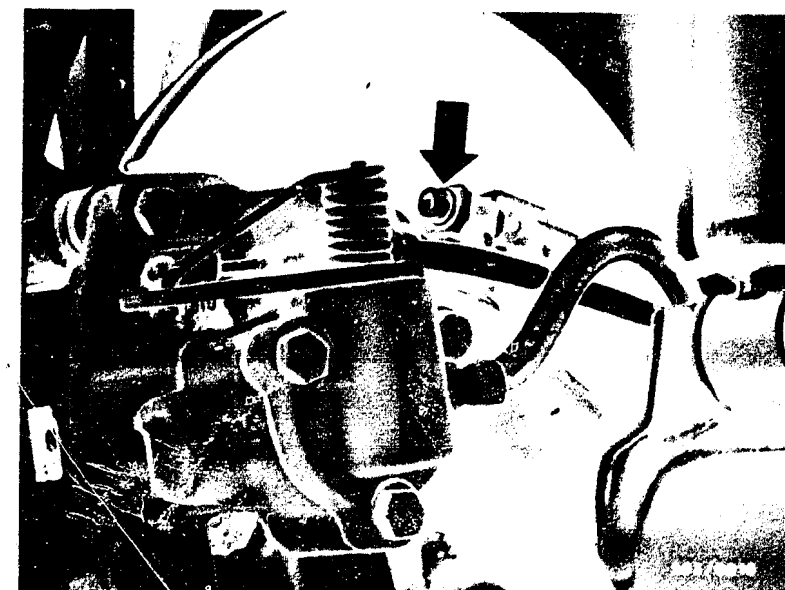
A reading of 999 means:

Brake test stand speed excessive (above approx. 13 km/h).



Arrow = Wheel-speed sensor – plug connection below rear seat in Audi 200

Arrow = Fastening screw for wheel-speed sensor



Continued H03

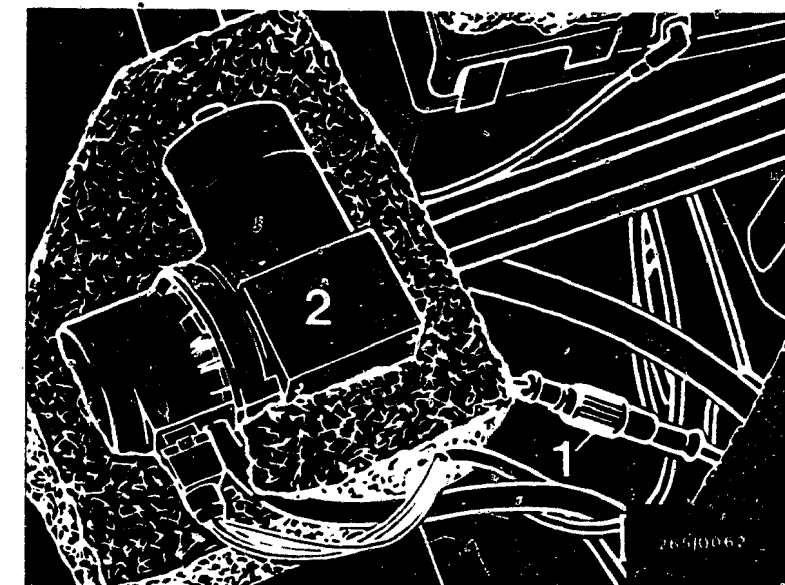
Continued on next coordinate

Reading 0 for less than 1.7

- * Are wheel-speed sensors transposed (incorrectly connected)?
Check connection: The wheel-speed sensors must correspond to the specified wheel and controller inputs (see circuit diagram).
- * Is the air gap between the wheel-speed sensor and ring gear excessive?
Check installation: Is there a plastic cap on the wheel-speed blade and is it correctly positioned?
Is the wheel-speed sensor installed all the way to stop?
- * Inspect wheel-bearing clearance.
- * Replace wheel-speed sensor.

Removing wheel-speed sensors on rear axle

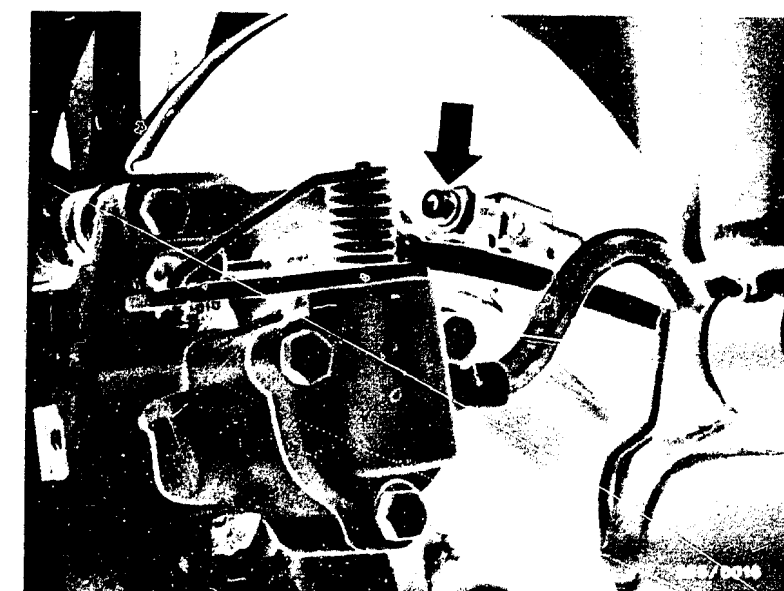
- * Disconnect the wheel-speed sensor plug connection under the rear seat.
- * Remove the rear seat.
Unscrew cover strip from ridge.
Turn back carpeting and disconnect plug connection.
- * Unscrew the lead fasteners on the superstructure in the rear compartment and trailing arms of rear axle.
- * Unscrew the wheel-speed sensor fastening screw and pull out wheel-speed sensor.
Do not use force!



In the Audi 100 and 200
(from 9.83):

- 1 = Wheel-speed sensor –
plug connection below
rear seat on the right
- 2 = Pump for central locking
system

Arrow = Fastening screw for
wheel-speed sensor



Continued on next microimage

Installing wheel-speed sensors at the rear axles

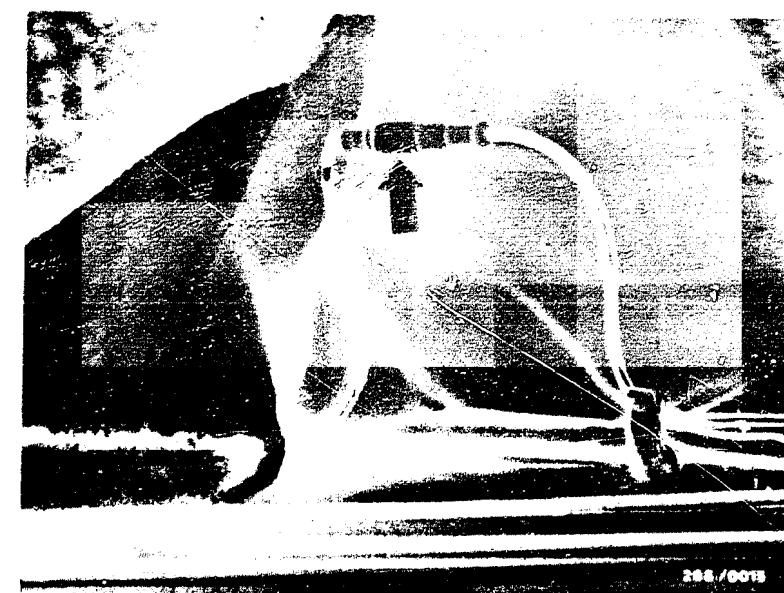
- * Check O-ring for cracks and if necessary replace.
- * Always replace the plastic tip on the wheel-speed sensor blade! Make sure it is correctly seated!
- * Grease the wheel-speed sensor housing with Molykote Long-term 2 lubricant.
- * Carefully push the wheel-speed sensor into its recess until the stop on the ring gear is reached. Do not strike! The correct air gap is established by the plastic tip.
- * Use new micro-encapsulated fastening screw. Tighten the fastening screw to 6...8 Nm. During tightening, press the wheel-speed sensor into the recess by hand. This prevents the sensor from lifting itself away from the ring gear, resulting in an excessive air gap.
- * Pull the lead into the engine compartment and reaffix at the places provided.

Note:

The fastening points of the wheel-speed-sensor lead on the trailing arms of the rear axle are marked with a white and red stripe.

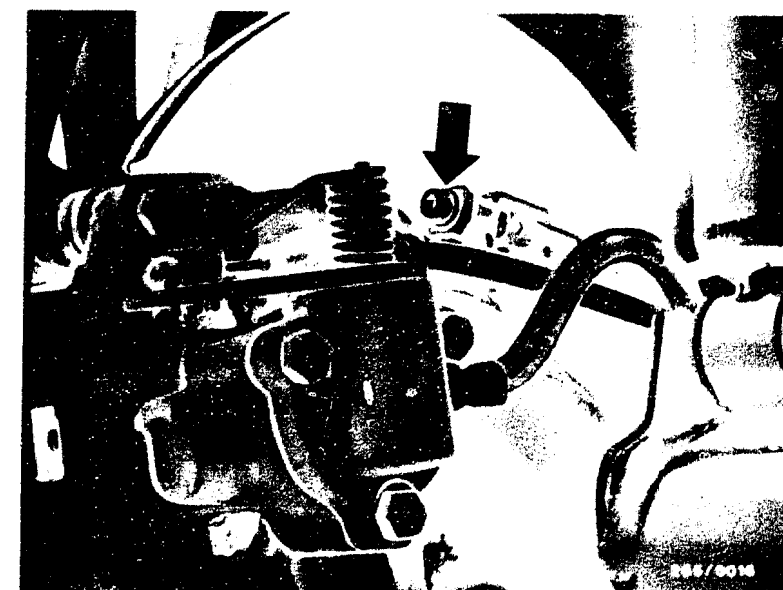
- * Connect wheel-speed sensor to ABS wiring harness.
- * After repair, test with the ABS tester.

Continued on next microimage



Arrow = Wheel-speed sensor –
plug connection below
rear seat in Audi 200

Arrow = Fastening screw for
wheel-speed sensor



TEST STEP 37

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Hydraulic modulator.
Incorrect connection (trans-
position), check of brake lines
at rear axle.

N>

Operation:

Program-switch position:

20

- * Select left rear wheel with button HL.
- * Switch on left brake roller.
- * Depress brake pedal until the braking-force reading on the brake test stand is 1200 N (120 kp).
- * Depress illuminated button.
- * Pressure reduction at the wheel selected (left rear) should follow.
- * Release brake pedal and illuminated button (in that order - otherwise the vehicle will jump out of the rollers).

Operation in vehicle:

Let engine run.

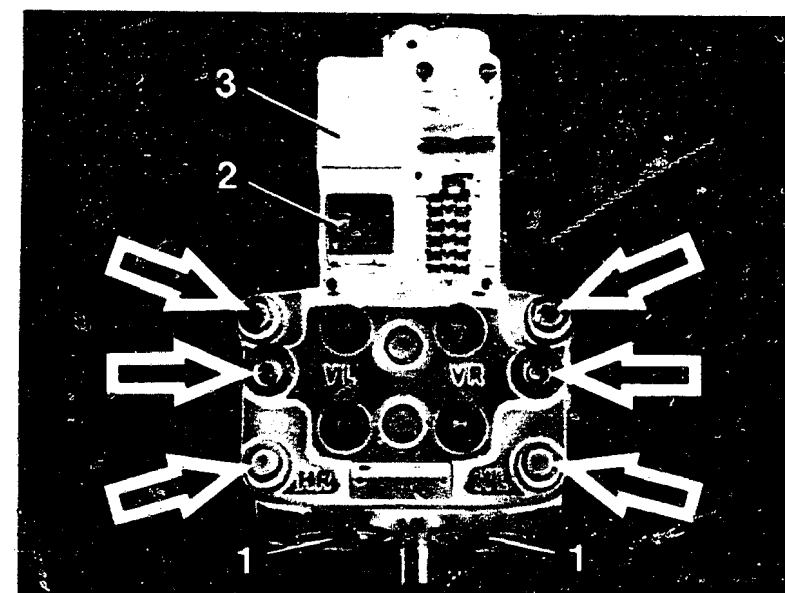
Test specification (reading):

BPS reading for left wheel:
less than 800 N (80 kp)

Is the measured value below 800 N ?

Trouble-shooting:

- * Lamp 2 (red) must not light up.
- * Repeat test.
- * Are the brake lines at the hydraulic modulator incorrectly connected (transposed) ?
Note markings.
- * Test the correspondence of brake roller to buttons HR and HL again.



- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Motor relay
- VL = Connection for left front brake line (wheel brake cylinder)
- VR = Connection for right front brake line (wheel brake cylinder)
- HR = Connection for right rear brake line (wheel brake cylinder)
- HL = Connection for left rear brake line (wheel brake cylinder)

IMPORTANT !

The Allen screws (arrows) must never be loosened. If they are loosened, the brake circuit can no longer be sealed. This can be fatal!

Continued on next coordinate

TEST STEP 38

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Hydraulic modulator.
Incorrect connection (trans-
position) check of brake lines
at rear axle.

N>

Operation:

Program-switch position:

20

- * Select right rear wheel with button HR.
- * Switch off the left brake roller and switch on the right brake roller.
- * Depress brake pedal until the brake test stand braking-force reading is 12 00 N (120 kp).
- * Depress illuminated button.
- * Pressure reduction at the wheel selected (right rear) should follow.
- * Release the brake pedal and illuminated button (in this order - otherwise the vehicle will jump out of the rollers).

Operation in vehicle:

Let engine run.

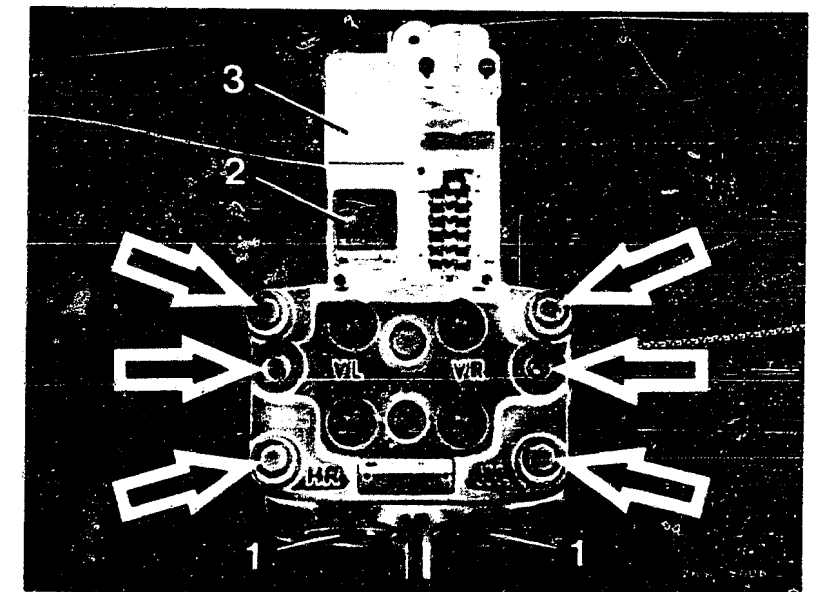
Test specification (reading):

BPS reading for right wheel:
less than 800 N (80 kp)

Is the measured value below 800 N ?

Trouble-shooting:

- * Lamp 2 (red) must not light up.
- * Repeat test.
- * Are the brake lines at the hydraulic modulator incorrectly connected (transposed) ?
Note markings.
- * Test the correspondence of brake roller to buttons HR and HL again.



- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Motor relay
- VL = Connection for left front brake line (wheel brake cylinder)
- VR = Connection for right front brake line (wheel brake cylinder)
- HR = Connection for right rear brake line (wheel brake cylinder)
- HL = Connection for left rear brake line (wheel brake cylinder)

IMPORTANT !

The Allen screws (arrows) must never be loosened. If they are loosened, the brake circuit can no longer be sealed.
This can be fatal!

Continued on next coordinate

Component/Function:

Hydraulic modulator.

Test of pressure reduction in left rear wheel brake cylinder.

Operation:

Program-switch position:

20

N>

- * Switch on the left and right brake rollers.
- * Select the right rear wheel with button HL.
- * Depress the brake pedal until the brake test stand instrument shows 1200 N (120 kp) for right wheel.
The pedal braking force must not be changed during the entire test!
- * The right reading may deviate from the left reading by max. 500 N (50 kp).
- * Depress the illuminated button until testing is over (approx. 10 seconds).
- * Note the left reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

Test specification (reading):

BPS reading for left wheel:

less than 800 N (80 kp)

Is the measured value below 800 N ?

Trouble-shooting:

- * Lamp 2 (red) must not light up.
- * Repeat testing twice and make sure that the braking force is not altered during testing.
- * Is the rest of the brake system OK ? Well bleed ?
Are the brake-line connections sealed ? Are the brake linings OK ?
The brake linings must not be "glassy".
Are the brake disks OK ?
The brakes must be generally "grippy".
Are the master and wheel cylinders OK ?
The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Check the ground terminal on the pump motor and the body.
- * Check the positive terminal on the pump motor.
- * Replace the hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

TEST STEP 40

(TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Hydraulic modulator.

Test of pressure reduction in right rear wheel brake cylinder.

Operation:

Program-switch position:

20

N>

- * Switch on the left and right brake rollers.
- * Select the right rear wheel with button HR.
- * Depress the brake pedal until the brake test stand instrument shows 1200 N (120 kp) for right wheel. The pedal braking force must not be changed during the entire test!
- * The right reading may deviate from the left reading by max. 500 N (50 kp).
- * Depress the illuminated button until testing is over (approx. 10 seconds).
- * Note the right reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

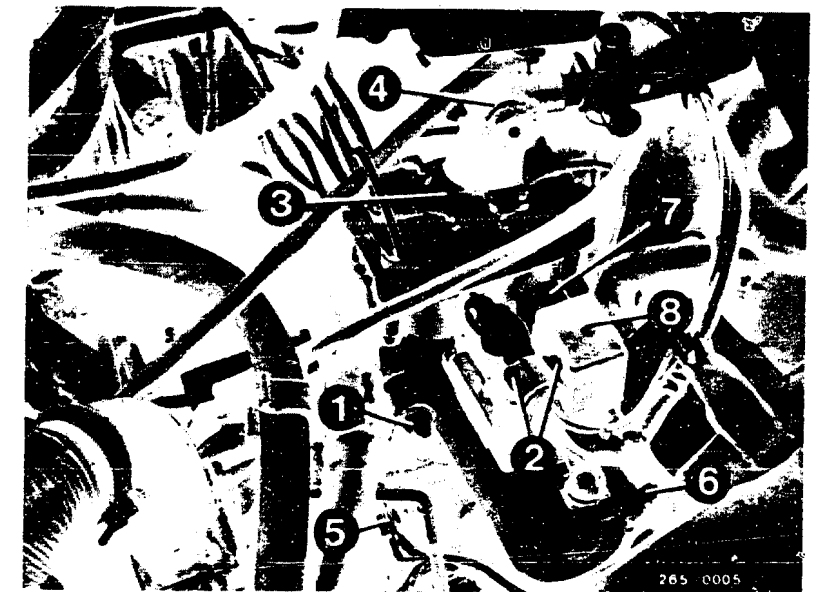
Test specification (reading):

BPS reading for right wheel:
less than 800 N (80 kp)

Is the measured value below 800 N ?

Trouble-shooting:

- * Lamp 2 (red) must not light up.
- * Repeat the test twice. Make sure that the braking force mains unaltered during the entire test (let engine run).
- * Is the rest of the brake system OK ? Well ventilated ? Are the brake-line connections sealed ? Brake linings OK ? Brake linings must not be "glassy". Brake disks OK ? The brakes must be generally "grippy". Are the main and wheel brake cylinders OK ? The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Inspect the ground terminals on the pump motor and body.
- * Check positive terminal at pump motor.
- * Replace the hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

H09

<=>

H10

<=>

Component/Function:

Hydraulic modulator.

Test of pressure buildup in left rear wheel brake cylinder.

N>

Operation:

Program-switch position: 21

- * Switch on both brake rollers.
- * Select the left rear wheel with button HL.
- * Depress the brake pedal until the brake test stand instrument shows 1200 N (120 kp) for left wheel.
- * The pedal braking force must not be changed during the entire test!
- * Depress illuminated button until testing is over (approx. 10 seconds).
- * Note the left reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

Test specification (reading):

BPS reading for left wheel goes back to an intermediate value and then rises to
400...1100 N (40...110 kp)

Is the measured value OK ?

Trouble-shooting:

- * Repeat testing twice and make sure that the braking force is not altered during testing (let engine run).
- * Is the rest of the brake system OK? Well ventilated? Are the brake-line connections sealed? Brake linings OK? The brake linings must not be "glassy". Brake disks OK? The brakes must be generally "grippy". Are the master and wheel brake cylinders OK? The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Inspect the ground terminals on the pump motor and the body.
- * Check positive terminal on pump motor.
- * Replace the hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

Component/Function:

Hydraulic modulator.

Test of pressure buildup in right rear wheel brake cylinder.

N>

Operation:

Program-switch position: 21

- * Switch on both brake rollers.
- * Select right rear wheel with button HR.
- * Depress the brake pedal until the brake test stand instrument shows 1200 N (120 kp) for right wheel.
- * The pedal braking force must not be changed during the entire test!
- * Depress illuminated button until testing is over (approx. 10 seconds).
- * Note left reading.
- * Release the brake pedal and illuminated button (in that order).

Operation in vehicle:

Let engine run.

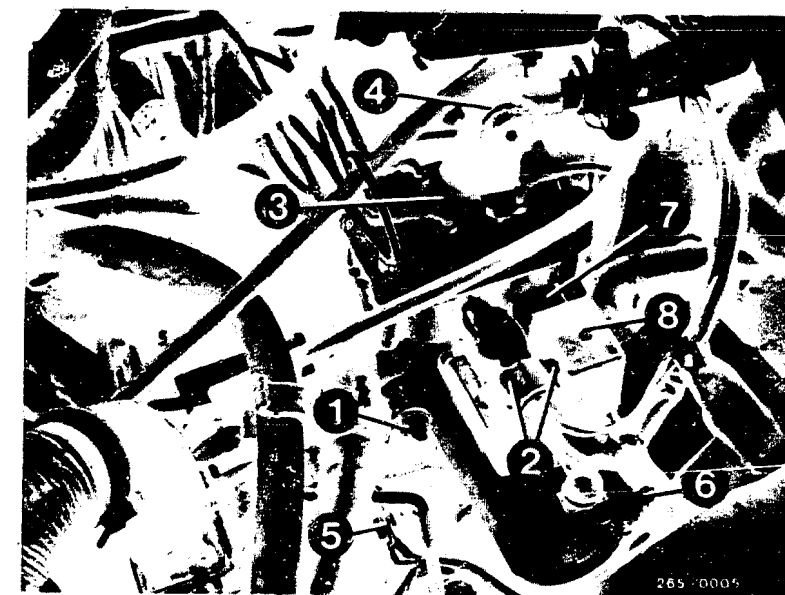
Test specification (reading):

BPS reading for right wheel goes back to an intermediate value and then rises to 400...1100 N (40...110 kp)

Is measured value OK ?

Trouble-shooting:

- * Repeat testing twice and make sure that the braking force is not altered during testing (let engine run).
- * Is the rest of the brake system OK? Well ventilated? Are the brake-line connections sealed? Brake linings OK? The brake linings must not be "glassy". Brake disks OK? The brakes must be generally "grippy". Are the master and wheel brake cylinders OK? The wheel brake cylinders and brake linings must show freedom of motion, if necessary clean them.
- * Inspect the ground terminals on the pump motor and the body.
- * Check positive terminal on pump motor.
- * Replace the hydraulic modulator.



- 1 = one of three fastening points
- 2 = Screws for wiring-harness strain-relief clamp
- 3 = Hydraulic modulator
- 4 = Brake master cylinder
- 5 = Ground terminal for ABS
- 6 = Ground terminal at pump motor
- 7 = Valve relay
- 8 = Motor relay

Continued on next coordinate

Replacement of hydraulic modulator

Is replacement not necessary ?

N>

Removing the hydraulic modulator:

- * For safety reasons, the hydraulic modulator must not be repaired, but may only be replaced complete.

The motor and valve relays are excepted.
Both relays may be replaced.

- * With the exception of the brake-line connections, no screws on the hydraulic modulator may be loosened.

The Allen-head screws (arrows) in particular must under no circumstances be loosened.

After they are loosened, the brake circuits cannot be re-sealed!
This can be fatal!

- * Visually inspect the hydraulic modulator and brake-line connections for leakage.

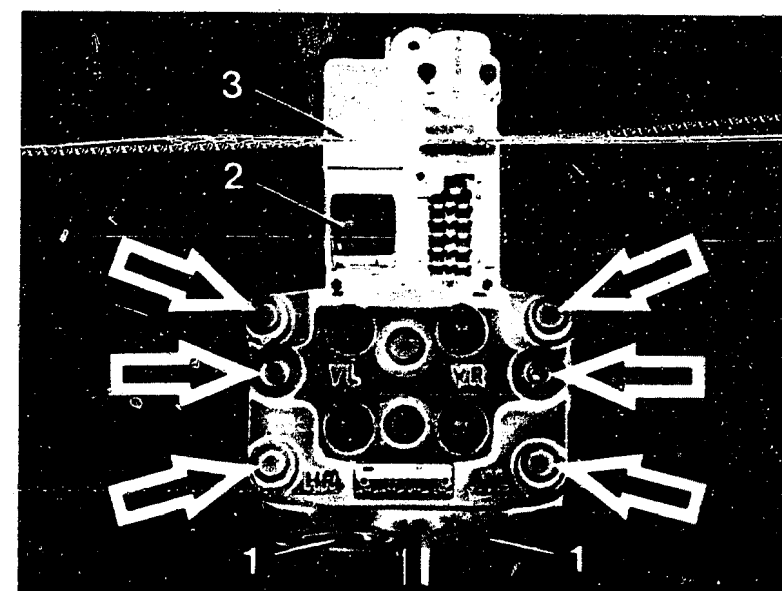
If brake fluid escapes, tighten the brake-line connections (12...16 Nm) or replace/exchange the hydraulic modulator.

Continued on next coordinate



3 = Hydraulic modulator

- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Motor relay



Testing with the ABS tester has been completed.

As a final test, carry out a test drive!

With the engine running or when 6 km/h is exceeded, the warning lamp should go out.

Drive at least 30 km/h. The warning lamp must not come back on.

TEST STEP 43 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

Pay particular attention to the sealing points designated with arrows (illustration):

A ventilation hole to the pump plungers is located on the floor of the hydraulic pump modulator.

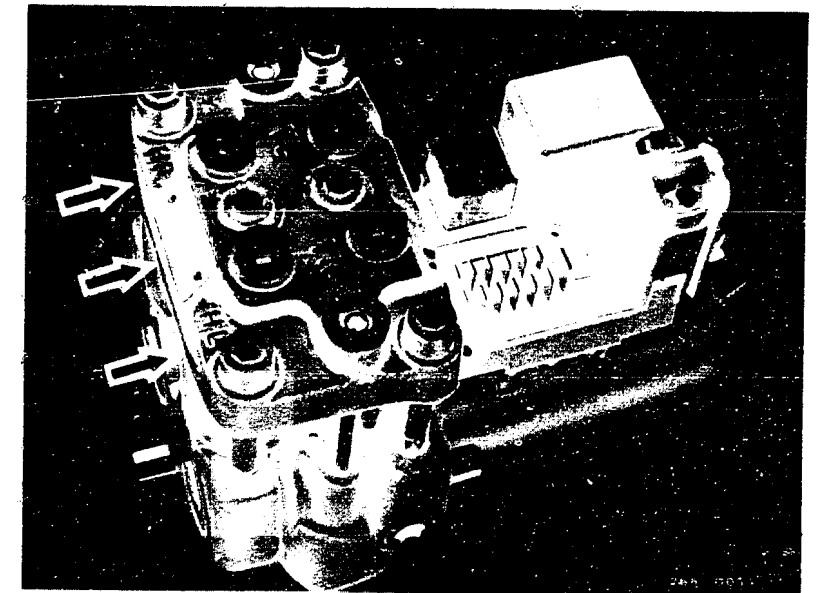
Slight leakage of brake fluid is possible at this point.

A complaint in this regard is justified only when a puddle of brake fluid forms underneath the hydraulic modulator after the brake pedal is operated several times.

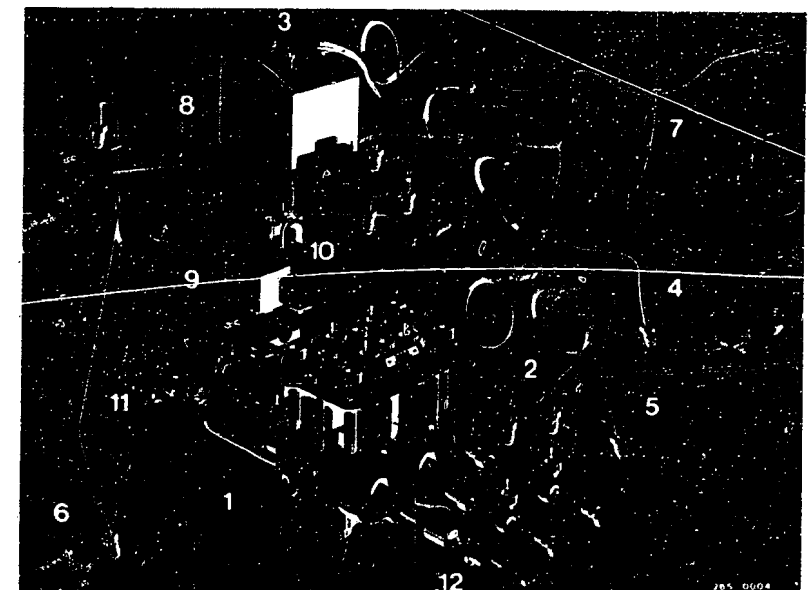
* When removing and installing the brake linings, make sure that the leads are marked in accordance with the markings on the hydraulic modulator, and are re-connected correctly (for example, VL from hydraulic modulator must be connected to the left front wheel-brake cylinder).

* Designation on hydraulic modulator:

VL =Connection for left front brake line (wheel brake cylinder)
 VR =Connection for right front brake line (wheel brake cylinder)
 HR =Connection for right rear brake line (wheel brake cylinder)
 HL =Connection for left rear brake line (wheel brake cylinder)



- 1 = Hydraulic modulator
- 2 = Brake lines to brake master cylinder
- 3 = Screw for cover
- 4, 5, 6, 7 = Brake line to fixed brake calipers HL, HR, VL, VR
- 8 = Hood
- 9 = Engine relay
- 10 = Valve relay
- 11 = Ground cable for pump motor
- 12 = Holder



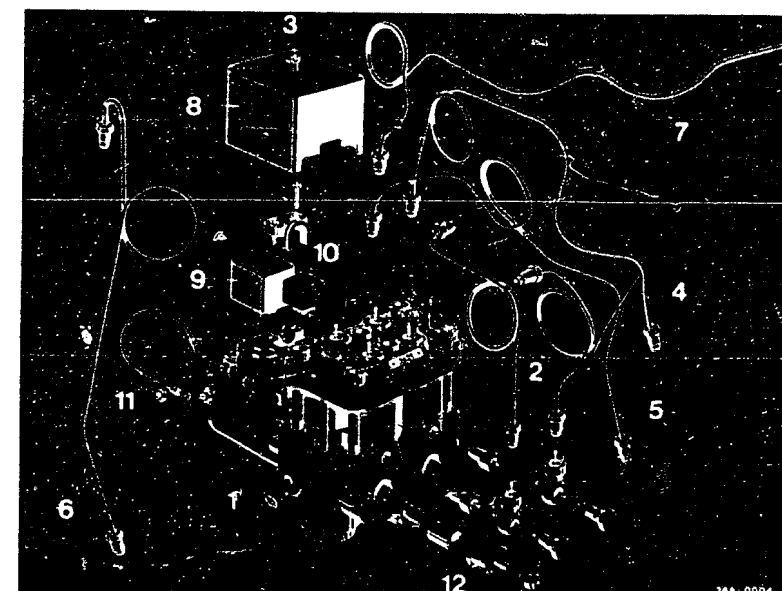
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TEST STEP 43 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

- * Use only the prescribed 9 x 11 mm double-head box wrench for loosening and tightening the brake lines.
- * Mark the brake lines and disconnect from hydraulic modulator.
- * Catch brake fluid and do not allow it to come into contact with skin, clothing, or paint!
- * Immediately plug brake lines and ports with dummy plugs.
- * Disconnect the ground lead(11) at pump motor.
- * Loosen fastening screw and remove hood.
- * Disengage clip and remove plug.
- * Loosen hex nuts on bracket (12) and remove hydraulic modulator.

Installation

- * Position hydraulic modulator in bracket and fasten with hex nuts.
- * Connect ground lead to pump motor. Plug in 13-pin plug and fasten with clip.
- * Affix hood (8) with screw (3) on hydraulic modulator.
- * Connect brake lines to hydraulic modulator in accordance with marking.
- * Use correct tightening torque for brake-line connections at hydraulic modulator: 12...16 mm.
- * Bleed brake system and check for leakage.
- * Carry out complete inspection of ABS with tester.



- 1 = Hydraulic modulator
- 2 = Brake lines to master cylinder
- 3 = Screw for cover
- 4 = Brake line to left rear fixed brake caliper
- 5 = Brake line to right rear fixed brake caliper
- 6 = Brake line to left front fixed brake caliper
- 7 = Brake line to right front fixed brake caliper
- 8 = Cover
- 9 = Motor relay
- 10 = Valve relay
- 11 = Ground lead for pump motor
- 12 = Holder

INDEX OF PASSENGER-CAR ABS SERVICE CENTERS INSIDE AND OUTSIDE GERMANY

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VDT-I-265/101 En
08.1984

supersedes Ed. 04.1983

The below-listed firms meet the requirements
for performing after-sales service on
BOSCH PASSENGER-CAR ABS systems 2 and 2 B
and have the necessary service equipment.

Wilhelm Wissel GmbH & CO. KH
Bosch-Vertragsgroßhändler
Würzburger Str. 62 - 68
8750 Aschaffenburg

Ing. Josef Kalveram
Bosch-Vertragsgroßhändler
Hallenstraße 9 - 11
4800 Bielefeld

Otto Dürer KG
Bosch-Vertragsgroßhändler
Biberbachstraße 1
8900 Augsburg

Brunn GmbH & Co. KG
Bosch-Vertragsgroßhändler
Jusutus-von-Liebig-Str. 24
5300 Bonn

Alber GmbH
Bosch-Dienst
Industriestraße 17
7150 Backnang

Philipp Wolf GmbH & Co. KG
Bosch-Vertragsgroßhändler
Hannoversche Straße 33/34
3100 Celle

A. Rexroth
Bosch-Dienst
Kleine Industriestr. 11
6430 Bad Hersfeld

Bunte & Knebelkamp GmbH
Bosch-Dienst
Daimler-Straße 8
4590 Cloppenburg

Knobel & Keydel
Bosch-Vertragsgroßhändler
Thyssenstraße 1 - 5
1000 Berlin 51

Georg Gening GmbH
Bosch-Dienst
Abschnede 205
2190 Cuxhaven

Gebr. Roskoden
Bosch-Vertragsgroßhändler
Sachsendamm 2
1000 Berlin 62

Franz Strobl GmbH & Co.
Bosch-Vertragsgroßhändler
Otto-Röhm-Straße 68
6100 Darmstadt

Eugen Boss GmbH & Co. KG
Bosch-Vertragsgroßhändler
Rosemeyerstr. 14
4600 Dortmund

Alfred Kruse Nachf. GmbH & Co.
Bosch-Vertragsgroßhändler
Eiffestraße 10
2000 Hamburg 26

Soeffing GmbH & Co.
Bosch-Vertragsgroßhändler
Mindener Str. 12 - 26
4000 Düsseldorf

Peters
Bosch - Dienst
Winsener Str. 231
2100 Hamburg 90

Vinzenz Radl KG
Inh. Frank Bischoff
Bosch Service
Spitalstraße 10
7930 Ehingen

August Coler
Bosch-Dienst
Münsterstr. 6 b
4700 Hamm

Emil Schmolk GmbH
Bosch Dienst
Weiherstraße 2
7830 Emmendingen

Hans Habenicht KG
Bosch-Service
Sandstraße 6 - 8
3000 Hannover

A - E Wilhelm Gerhardt
Bosch-Dienst
Wolfsbankring 23
4300 Essen-Borbeck

E. G. Maurer GmbH
Bosch-Vertragsgroßhändler
Vahrenwalder Str. 253
3000 Hannover 1

Dipl.-Ing. Karl Schmitt
Bosch-Vertragsgroßhändler
Ohmstraße 1 - 9
6000 Frankfurt (Main) 90

Heinz Betz
Bosch-Dienst
Industriestraße 36
8728 Hassfurt

Keller & Schneider GmbH
Bosch-Vertragsgroßhändler
Lörracher Str. 43
7800 Freiburg

Dietrich KG
Bosch-Vertragsgroßhändler
Eitzelstraße 29
7100 Heilbronn

Armin Eschenbacher
Bosch-Dienst
Frankfurter Str. 29
8780 Gemünden

Wilfried Hagemeyer
Bosch-Dienst
Ernstmeierstraße 24
4900 Herford

Ludwig Fetzer GmbH & Co. KG
Bosch-Vertragsgroßhändler
Steinstraße 81 - 83
6300 Gießen

Karrer & Barth GmbH & Co. KG
Bosch-Vertragsgroßhändler
Kussmaulstraße 13
7500 Karlsruhe

Werner D r o e g e KG
Bosch-Vertragsgroßhändler
Preetzer Straße 304
2300 K i e l 14

G. Neuerburg GmbH & Co. KG
Bosch-Vertragsgroßhändler
Wöhlerstraße 35
5000 K ö l n 30

Wisser & Münch GmbH & Co. KG
Bosch-Dienst
Bergisch-Gladbacher Str. 240
5000 K ö l n 80

Auto-Elektro-Thiel
Bosch-Dienst
Siemensstraße 3
8650 K u l m b a c h

Adolf B ü k e r
Bosch-Dienst
Heidensche Straße 80
4937 L a g e / Lippe

Josef D o l l e
Bosch-Dienst
An der Bundesstr. 236
5940 Lennestadt 11 /
Grevenbrück

Philipp Scherer GmbH & Co. KG
Bosch-Dienst
Konrad-Kurzbold-Straße 6
6250 L i m b u r g

Schöberl GmbH & Co. KG
Bosch-Vertragsgroßhändler
Ziegelstraße 11
2400 L ü b e c k 1

Wilhelm Schöneborn Nachf. KG
Bosch-Vertragsgroßhändler
Altener Straße 70
5880 L ü d e n s c h e i d

Heinrich Kocher GmbH & Co.
Bosch-Vertragsgroßhändler
Heppenheimer Str. 13 - 15
6800 M a n n h e i m 31

Ing. Heinrich K r a t z
Bosch-Dienst
Hülsdonker Str. 130
4130 M o e r s 1

Franz-Josef Z e r w e s
Bosch-Dienst
Saarstraße 28
5552 Morbach (Hunsrück)

Gunter G e r b e r
Bosch-Service
Adlzreiter Straße 17
8000 M ü n c h e n 2

Paul H o h m a n n
Bosch-Dienst
Wilhelm-Hagen-Str. 4
8674 N a i l a

Vogtmann & Herold & Co. GmbH
Bosch-Dienst
Danziger Straße 4
5450 N e u w i e d 1

P l ö g e r GmbH
Bosch-Dienst
Bahnhofstraße 90
4811 Oerlinghausen 2

Karl Haug KG
Bosch-Vertragsgroßhändler
Erich-Maria-Remarque-Ring 14
4500 O s n a b r ü c k

D. Hartlage GmbH & Co. KG
Bosch-Dienst
Pagenstecher Str. 35
4500 O s n a b r ü c k

Helmut E i m e r
Bosch-Dienst
Landauer Str. 36
8350 P l a t t l i n g

Edmund Klais OHG
Bosch-Vertragsgroßhändler
Neuenkamper Str. 22 - 28
5630 R e m s c h e i d

Ludwig K l a p s KG
Bosch-Vertragsgroßhändler
Hemelter Str. 74 - 78
4440 R h e i n e

Karl S c h m i t z KG
Bosch-Vertragsgroßhändler
Sonnenstraße 3
8200 R o s e n h e i m

M a r x GmbH
Bosch-Dienst
Heinrich-Hertz-Straße 11
2380 S c h l e s w i g

Erich Mezger GmbH & Co.
Bosch-Vertragsgroßhändler
Werner-von-Siemens-Str. 6
8720 Schweinfurt

Richard Römer GmbH & Co.
Bosch-Vertragsgroßhändler
Sieghütter Hauptweg 11-15
5900 S i e g e n 1

Hans N a g e l GmbH
Bosch-Dienst
Hansestraße 20
2160 S t a d e (Elbe)

Dorner & Volbach
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Rudolf-Diesel-Str. 1
5500 T r i e r

Jakob W e i l e r KG
Bosch-Vertragsgroßhändler
Metternichstraße 6
5500 T r i e r

Julius Mack GmbH & Co. KG
Bosch-Dienst
Herrlinger Straße 64
7900 U l m (Donau)

Wörner GmbH & Co. KG
Bosch-Dienst
Würzburger Str. 26
6968 W a l l d ü r n

Robert Walloschke
Bosch-Dienst
Nürnberger Str. 53
8832 Weissenburg

Berthold M e n g e s
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Please direct questions and comments
concerning the contents to our authorized
representative in your country.

TECHNICAL BULLETIN

REPAIR PROHIBITION / MAXIMUM ALLOWABLE STORAGE TIME FOR ABS HYDRAULIC MODULATORS

13....39
VDT-I-265/102 En
1.1986

Replaces edition of 7.1984

1. Repair prohibition

ABS for passenger vehicles is a safety system.

Unauthorized tampering with ABS components brings with it the danger of impairment of the proper functioning of the ABS system.

For reasons of safety, therefore, the
hydraulic modulator may under no circum-
stances be repaired, but instead must be
exchanged as a complete unit.

Only the engine and valve relays may be exchanged.

No other screws or plugs may be loosened or removed.

2. Maximum allowable storage time

The maximum allowable storage time for hydraulic modulators is 5 years from the date of manufacture (FD) specified on the product.

This requires that the following storage conditions be fulfilled:

- Hydraulic modulator filled with brake fluid (supplied in filled condition).
- Vertical/upright position (hood on top).
- Ambient temperature between -20°C and +50°C.
- Dry storage.

After 5 years storage time, all rubber and plastic parts must be replaced and the hydraulic modulator must be subjected to a functional test.

The replacement of rubber and plastic parts and the functional test can be carried out only at the place of manufacture. After testing, the hydraulic modulators are marked with **|L|** and a new date of manufacture (FD).

Service workshops in the Federal Republic of Germany should send the hydraulic modulators to:

Robert Bosch GmbH Abt. K1/VAK 2,
Robert-Bosch-Straße, 7141 Schwieberdingen.

Service workshops in other countries are requested to send the hydraulic modulators to:

Robert Bosch GmbH, KH/LAV 2 - Auspackraum,
z.W. an K1/VAK 2, Auf der Breit 4,
D-7500 Karlsruhe 41
West Germany.

The hydraulic modulators should be sent to us pre-paid. Please refer to this Technical Bulletin on the enclosed delivery ticket.

A fee is charged for parts replacement and functional testing.

Responsible:

ROBERT BOSCH GMBH

Division KH

Technical After-Sales Service (KH/VKD 2)

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For production reasons:
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